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NATIONAL

NARROW-GAUGE

RAILROAD CONVENTION.

PROCEEDINGS

OF THE

NATIONAL NARROW GAUGE

RAILWAY CONVENTION,

HELD AT

ST. LOUIS, MO., JUNE 19, 1872.

with compliments of
Chas. E. Howland

UM

ST. LOUIS, MO.:
BY THE "INDUSTRIAL AGE" PRINTING CO.
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PROCEEDINGS OF THE CONVENTION.

ST. LOUIS, June 19, 1872—11 A. M.

The Convention of railroad men, car and locomotive builders, and others interested, called to consider the question of narrow gauge railway construction and operation, assembled at the Southern Hotel, at 11 o'clock A. M., in accordance with the following

INVITATION AND PROGRAMME

issued by a Committee of Arrangements appointed early the present year:

"In view of the fact that the gauge question, as applied to railways, is attracting a large share of attention, and that there is a general desire in the public mind to arrive at an intelligent conclusion in relation thereto, the following points for discussion and elucidation are suggested:

"1. The want of railway facilities.

"2. The comparative cost of the two systems.

"3. Our means of constructing the broad gauge as compared with the narrow gauge.

"4. The comparative cost of operating the two gauges.

"5. Can narrow gauge locomotives be constructed of sufficient power and speed to answer general requirements?

"6. Can the passenger coaches be made safe, comfortable and popular with the traveling public?

"7. Can freight cars be constructed of convenient size for the transportation of cotton, live stock and general freights?

"8. What saving in dead weight will the narrow gauge effect?

"9. How will the saving in first cost and dead weight affect the rates of freight and passage?

"10. Break of gauge or connections.

"11. Experience and opinions of experts.

"12. The narrow gauge, as compared with the broad gauge, as the means of development.

"Your committee are of the opinion that a full discussion of the points named will elicit much valuable information, which if given to the public by the press, will result in great good. The object of the Convention should be to arrive at the truth by the light of facts derived from actual experience, and, what is of the first importance, determine upon a uniform narrow gauge. There is no antagonism between the two systems. The narrow gauge will be a powerful adjunct to the broad gauge, and in many instances prove to be the saviour of the old lines by bringing to them a large new business, and thus convert non-paying into dividend paying roads. Unquestionably the narrow gauge is entitled to a place in our railway system, and it will be the duty of the Convention to determine what that place shall be, as well as to suggest a wisely considered plan of extension of the system, in order that the country may receive the full benefit therefrom.

"We cordially invite and earnestly urge all narrow gauge companies in operation, all in the course of construction, all manufacturers of narrow gauge motive power and rolling stock, to send a full representation to the Convention to be held in St. Louis the 19th of June, 1872. E. Hulbert, Secretary."

ORGANIZATION.

Mr. C. H. Howland, of St. Louis, called the meeting to order, and nominated Hon. Erastus Wells, of St. Louis, temporary Chairman, who was elected, together with Col. E. Hulbert, of Georgia, as temporary Secretary.

ADDRESS OF THE TEMPORARY CHAIRMAN.

Mr. Wells, referring to the terms of the call, said it was not necessary to enter at present farther into the objects of the meeting. He had been introduced, the preceding day, to gentlemen from Georgia, Virginia, Delaware, Alabama, Pennsylvania, Colorado, and other portions of the country, showing that this matter is taking hold of the people. And when gentlemen can come so far from home at this season of the year—through the heat and the dust--there must be something in this movement which the people are taking hold of. And he was satisfied, with what little information he had, simply through the newspapers and in conversation with citizens, that the day is not far distant when narrow gauge roads will be as popular and effective as the present system.

On motion of P. B. Borst, of Virginia, the Chairman appointed a committee of three to enroll the names and addresses of those present.

Hon. P. B. Borst of Virginia, A. W. Bell, of Pennsylvania, and

Col. W. C. Faulkner, of Mississippi, were appointed said committee.

The committee reported the following

LIST OF DELEGATES PRESENT.

O. F. Prescott, Pres't Mem. & Ral., Memphis, Tenn.

R. L. Cobb, Chief Eng. Memphis & Ral., Memphis.

J. A. Wiggs, Corinth & Nashville.

Thos. H. Millington, Ch'f Eng. Mem. & Knoxville, Bolivar, Tenn.

W. S. Moon, Ch'f Eng. Vicksburg & Nash., Okalona, Miss.

H. T. Wilson, Pres't Topeka, Ft. Scott & Mem., Ft. Scott, Kan.

W. C. Faulkner, Pres't Ripley Railroad, Ripley, Miss.

G. M. Priest, Pres't South Ky. Railroad, Henderson, Ky.

W. C. Richards, Ch'f Eng. Plymouth, Kan. & Pa., Kankakee, Ill.

W. H. Greenwood, General Manager Den. & Rio Grande, Denver, Col.

W. S. Auchincloss, Vice President Jackson & Sharp Man'g Co. Wilmington, Del.

Edmund Wragge, Ch'f Eng. Toronto, Grey & Bruce R., and Toronto & Nipissing Railroad, Toronto, Canada.

W. F. Goodhue, Civil Eng., Chicago *Railway Review*, Chicago, Illinois.

T. R. North, Attorney Des Moines Western R., Adel, Ia.

L. A. Grant, Director Des Moines Western R,. Des Moines, Ia.

E. Goughnour, Sup't Des Moines Western R., Adel, Ia.

G. H. Walser, Pres't Mo. Div. Ft. Scott & Memphis R., Lamar, Missouri.

T. S. Wilson, Vice Pres't Mem. & Fort Scott R., Fort Scott, Kan., and Gen'l Sup't Fort Scott, Jeff. City & St. Louis R.

G. A. Karwiese, Kansas City, Wyandotte & Northwestern.

A. W. Bell, Porter, Bell & Co., Pittsburg, Pa.

C. H. Howland, Cairo & St. Louis R., St. Louis, Mo.

R. H. Rosborough, Director Cairo & St. Louis R., Sparta, Ill.

A. Steele, Director C. & St. Louis R., Sparta, Ill.

Lucien Scott, Vice Pres't Kan. Central, Leavenworth, Kan.

J. B. Inman, Ch. Eng. Tenn. Central, Carroll, Tenn.

J. J. Williams, Jackson & Tenn. River Road, Jackson, Tenn.

O. G. Vanderhoff, Eng. Greenville & Paint Rock Road, Knoxville, Tenn.

J. G. Reeves, Pres't Greenville & Paint Rock Road, Greenville, Tenn.

J. E. Gregg, Sup't Ark. Central, Helena, Ark.

W. A. Smith, *Railway Register*, St. Louis.

S. N. Keith, Rhode Island & Mass. R., Providence, R. I.

Col. E. Hulbert, Pres't North Ga. & Nor. Car. R., Atlanta, Ga.

G. M. Edgerton, St. Louis & Manchester R., St. Louis.

S. B. Shaw, St. Louis & Western R., St. Louis.

W. M. Kasson, Eng. St. Louis & Western R.. St. Louis.

G. F. Dawson, Dawson & Bailey, Locomotive Works, Connellsville, Pa.

A. W. Maupin, Missouri Central, Union, Mo.

A. B. Garrison, Pres't St. Louis & Manchester R., St. Louis.

R. R. Powell, Chief Eng. St. Louis & Man. R., St. Louis.

E. Wells, Pres't Olive Street R., St. Louis.

L. H. Conn, Olive Street R., St. Louis.

O. Merriweather, Prentice & Bouge, Phalia. R.. Memphis, Tenn.

Hon. P. B. Borst, Pres't Washington, Cincinnati & St. Louis R. Luray, Va.

D. E. Small. Billmeyer & Small, car builders, York, Pa.

T. I. Carter, Colorado Central R., Denver, Col.

E. Morrison, Vice President St. Louis & Western R., St. Louis,

On motion of Col. E. Hulbert, of Georgia, a Committee of five on permanent organization were appointed. The Chair appointed Col. E. Hulbert of Georgia, Hon. P. B. Borst of Virginia, Col. W. C. Faulkner of Mississippi, C. H. Howland of St. Louis, and W. H. Greenwood of Denver.

PERMANENT OFFICERS.

The following, reported by the Committee, were elected:

President—Hon. Erastus Wells.

Vice Presidents—Gen. Wm. Palmer, Col.; L. Smith, Kansas; A. B. Garrison, Mo.; Anthony Steele, Ill.; G. M. Priest, Ky.; O. F. Prescott, Tenn.; J. E. Gregg, Ark.; W. C. Faulkner, Miss.; B. E. Wells, Ala.; E. Hurlburt, Ga.; P. B. Borst, Va.; Wm. S. Auchincloss, Del.; D. E. Small, Penn.; S. N. Keith, R. I.; E. Wragge, Toronto, Can.; T. E. Sickles, Neb.; L. A. Grant, Ia.

Secretaries—L. H. Conn, Mo.; W. C. Richards, Ill.

The President, on announcing the permanent organization of the Convention, expressed the hope that the proceedings would be harmonious and the results beneficial to all.

The Committee on Permanent Organization further recommended the appointment of a Committee of eleven to prepare a general report on the narrow gauge railway system, which recommendation was adopted by the meeting.

The meeting then took a recess until 2 1-2 P. M.

ST. LOUIS, June 19, 2 1-2 P. M.

COMMITTEE ON REPORT.

The Chair announced the following Committee, to report on the narrow gauge question: W. H. Greenwood, E. Wragge, T. H. Millington, A. W. Bell, D. E. Small, Wm. L. Auchincloss, E. Hulbert, Lucien Scott, Chas. H. Howland, W. M. Kasson, P. B. Borst.

PRACTICAL MERITS OF THE NARROW GAUGE.

Before proceeding to a discussion of the practical claims of the narrow gauge, a dispatch was read by the Secretary, from W. D. Chipley, Columbus, Ga., Secretary of the "North and South Railroad," of Georgia, excusing his absence, and stating that he had found the narrow gauge a thorough success in every respect.

Charles H. Howland, of St. Louis, said, in common with the rest of the delegates, that he had come for information on the question of narrow gauges. As there were gentlemen present, who, in their official capacity, are intimately acquainted with the subject, he thought it would be very pleasant, if they would give this convention their experience and views. He referred to Col. Greenwood and Mr. Wragge.

DENVER AND RIO GRANDE—REMARKS OF COL. GREENWOOD.

Mr. Greenwood remarked that so far as he had treated the narrow-gauge system it had proved a decided success. The Denver and Rio Grande road had now one hundred and seventeen miles in operation. As to the

CAPACITY OF THE ROAD,

he had no hesitation in declaring it fully equal to that of a broad gauge road. It was only a three feet gauge, and yet he was unable to see any difference, as to capacity, in favor of broad-gauge. He could do as much business on this road as could be done on nineteen-twentieths of the broad-gauge roads. As to

SPEED,

they made all the speed they desired. With a party of Pennsylvania excursionists, the other day, they made an average of twenty-five miles an hour, although the usual rate, including stoppages, was fifteen, or about three-fourths of the average of broad-gauge roads. The public demand fast trains, and then punish Railroad Companies for any accident. If the Companies were permitted to choose, they would prefer slower time. He thought the policy should be to keep down speed, and thus lessen the liability to accidents. As to

LIABILITY TO ACCIDENTS,

he could give them no information whatever on that point, as no accident had occurred since the road had commenced running.

CAR EQUIPMENT.

Mr. Greenwood preferred the passenger coaches of the narrow gauge to those of the broad-gauge. His plan was to have a row of chairs or seats, on pivots, on each side of the coach. The loaded freight cars weighed less than the empty cars of a broad-gauge road. He got his iron *via* the Kansas Pacific Railroad, and ten of his cars would carry the load of eight of the Kansas Pacific Railroad cars, and each of his loaded cars are *one ton* lighter than the empty return cars of the Kansas Pacific Railroad. They had no difficulty in transporting cattle. Their cars were made a little longer than the ordinary cattle cars of the broad-gauge. The doors instead of being at the side are placed at one end, and the cattle are driven through them into the car. .The engines work admirably and do all they were warranted to do. The freight engines had never been put to all the work they could do.

COMPARATIVE COST.

The cost of this road would furnish no criterion. It was built along the base of the Rocky Mountains, over a very rough country, where the Engineers sometimes had great difficulty in making their way for the purpose of a survey. In giving the estimates they had included the cost of transportation, and as they had to transport a very large proportion of their iron at very high rates, the estimate did not show a fair average of what their road had cost per mile. He submitted the following report of estimates for completing the unfinished division, as compared with a broad gauge, from which it appears that the narrow-gauge can be built for about sixty per cent. of the cost of a broad-gauge:

UNITED STATES RAILWAY OFFICE,
CIMARRON, NEW MEXICO, May 22, 1872.

Colonel W. D. Greenwood, General Manager Denver and Rio Grande Railroad:

DEAR SIR — In answer to your request for a statement, showing the comparative cost of building a broad-gauge road across the Rocky Mountains, as against the narrow-gauge, I take pleasure in sending you the subjoined compared estimates, with the hope that they may be of assistance to you in demonstrating the great advantage of narrow-gauge over the standard, in at least many localities, and especially in this country, The broad-gauge estimates are based upon actual and careful survey, over the whole distance from the north boundary of New Mexico to Cimarron. The narrow-gauge was surveyed over the heavy work only, but as this was the most important part, and having noted during the whole survey , that cuts and fills could be avoided by the use of a little more curvature, I feel perfectly safe in the estimate. For further comparison, as showing the relative difference in both plains and mountain work, I place the estimates under two heads, respectively, mountain and plains division:

COST OF FOUR FOOT EIGHT AND-A-HALF INCH GAUGE — DISTANCE THIRTY-FIVE MILES — MOUNTAIN DIVISION.

Grading, bridging and tieing, per mile,	$ 24,700
Total cost without iron,	864,500
Thirty-five miles iron, seventy pounds per yard, at $12,000,	420,000
Total,	$1,284,500

Average cost per mile, $36,700.
Maximum grades, 125 feet per mile.
Maximum curvature, ten degrees on 100 feet grades.

COST OF THREE FEET GUAGE—DISTANCE 40 MILES.—MOUNTAIN DIVISION.

Grading, bridging and tieing, per mile	$ 9,600
Total, without iron	384,000
Forty miles iron at 40 lbs. per yard, at $7,000	280,000
Total	$664,000

Average cost per mile, $16,600.
Maximum grades, 100 feet per mile.

Maximum curvature, 16 deg. to 18 deg. Saving in favor of narrow-gauge, $620,500; distance in favor of broad-gauge, five miles; narrow-gauge per cent. cost of broad-gauge, nearly 52. Two miles of the distance is lost to avoid tunnels, and the balance to reduce grades and avoid heavy rock cuts, and in some instances to avoid bridging and rip rap work.

PLAINS DIVISION.

(Surface work), broad-gauge, distance 42 miles:

Grading, bridging and tieing, at $3,900 - - - - -	$163,800
Forty-two miles iron, 56 lbs. per yard, at $9,500 -	399,000
Total - - - - - - - - - - -	$562,800

Average per mile, $13,400.

Maximum grades, 65 feet per mile.

Maximum curvature, 4 degrees.

Narrow-gauge, distance 42 miles:

Forty-two miles grading, bridging and tieing, per mile, $3,500 - - - - - - - - - -	$147,000
Forty-two miles iron, at 30 lbs. per yd., per mile, $5,150	216,300
Total - - - - - - - - - - -	$363,300

Average cost per mile, $8,650.

Grades and curvatures as above.

Saving cost in favor of narrow-gauge, $199,500. Distance equal; narrow-gauge per cent. cost of broad-gauge. 64.

ENTIRE LINE.

Broad-gauge, distance 77 miles, total cost - -	$1,874,300
Narrow-gauge, distance 82 miles, total cost - -	1,027,300
Total saving of cost in favor of narrow-guage, -	$820,000

Distance in favor of broad-gauge, five miles (by surveyed line, whereas it is probable that a cut-off can be made by a route yet unsurveyed, that will reduce the distance by ten or twelve miles, which route is certainly not practicable for broad-gauge).

Narrow-gauge per cent. cost of broad-gauge, 55 (nearly.)

W. E. MORELEY, Engineer.

THE TORONTO NARROW-GAUGE—REMARKS OF MR. WRAGGE.

Mr. Wragge gave a sketch of the system, three feet, six inches, built from Toronto, Ont., under his supervision. The Toronto, Grey & Bruce road runs northwest from Toronto to Sydenham, on Owen Sound, about 100 miles. Of this main line a section of 49 miles from Toronto is in operation to Orangeville; and on a branch from Orangeville, 39 miles to Mt. Forest—making 88 miles now operated. The remaining 40 miles of the branch, extending to Kinkardine, on the eastern shore of Lake Huron, is under construction. The Toronto and Nipissing railroad runs northeast from Toronto to Cobeconk, on Balsam Creek, 88 miles; and of this, 65 miles are in operation to Midland.—Mr. Wragge proceeded to give in detail the engineering characteristics of the road, characteristics of the country, and peculiar mechanical features of the cars and engines, dwelling at some length on the different styles of engines.

The sharpest curve on the Canada road was 14 degrees, and the maximum grade for the heaviest loads was 88 feet to the mile There was, however, one grade of 105 feet to the mile; and over this grade, on the 24th day of May last, one engine drew an excursion train containing 600 passengers. The engine was, however heavier than the ordinary narrow-gauge engines. It weighed 20 tons.

The cattle cars on the road are made to carry eight head of the largest cattle in the country. The greatest load they put upon a single car was eight tons.

BROAD-GAUGE IN TENNESSEE—REMARKS OF MR. MILLINGTON.

Thos. M. Millington, Chief Engineer of the Memphis and Knoxville railroad, read a valuable paper (see Appendix) giving comparative estimates of cost on the five feet and the three feet gauge, prepared from actual survey. The surface of the country through which the road passes is undulating, in places rolling and broken, but with no serious obstacle to the construction of a first-class road at the average cost per mile of Southern roads. The clearing and grubbing, where there is any, is heavy; grading all earthwork and easy to handle. There is but one bridge of three spans of 50 feet each. The prices of material and labor are such as are ruling in that section. Engineering, right of way, salaries, printing, etc., as much on the narrow as on the broad-gauge. Mr. Millington submitted estimates in detail. The saving in favor of the narrow-gauge is very great, amounting to $227,136 for 30 miles of road bed and superstructure. There would doubtless be some saving in the cost of rolling stock and equipment; but as this is controlled more by the amount of traffic the road has to perform than the gauge, he had not estimated it. Had the line been through a mountainous country, with heavy rock excavations, the narrow-gauge would have effected a much greater saving, which, though for a comparatively level country, amounts to 41 per cent.

Col. Greenwood said: "The moment you come to a double track, I can do more than any broad-gauge in the world without a double track.

NARROW-GAUGE IN GEORGIA—REMARKS OF COL. HULBERT.

Col. Hulbert, of Georgia, made an interesting statement of the workings of the narrow-gauge system in that State.

THE FIRST NARROW-GAUGE IN THE SOUTH.

The first of the Southern States to put up narrow-gauge tracks was Alabama. The road was six miles in length. It gave entire satisfaction. We have in course of construction one—of which eight miles of track is laid—and about forty-five miles of another; twenty-two miles in operation, with forty graded. The first cost $9,300 per mile, and the last $10,300. Notwithstanding he was satisfied with the experiment they had in charge, he determined to make a visit to this section of the country, and witness, himself, the roads in actual operation.

OBSERVATIONS ON ROADS IN THE WEST.

There was first the Kansas Central twenty-seven miles long. He saw it under very unfavorable circumstances, but they rode over the track at twenty miles an hour with perfect safety, and as much ease as they could have rode over a similar track on the broad-gauge. From there he went to the Denver and Rio Grande Railroad, which was the best illustration of the narrow-gauge principle. It is as near perfection as any broad-gauge road that was ever built. The cars ride more steadily than those of any road west of the Mississippi river. As to the comforts of the cars, he found no difference. True there was more leg room in the broad-gauge cars, but there were enough seats for comfort, and sitting with a gentleman on the same seat they were not uncomfortably crowded.

THE SYSTEM FOR THE SOUTH.

He desired the narrow-gauge in the South for many reasons. We have, for instance, in Georgia, thirty-two localities in which we have charters to build roads; but it does not pay. He maintained that if they could not have a five-foot gauge it was better to take three, and two feet was better than going on one foot. It was simply a necessity in the South. We frankly admit our inability to build the broad-gauge. For one, he was thankful that such was the case. The narrow-gauge system would cover the entire State and develop its resources, as the broad-gauge could never do. He gave Chattanooga as an illustration on this point. It was the centre of a mineral region in the South, swinging around it one hundred and fifty miles in diameter, with more minerals of a richer quality, than any other point in the known world. Within sight of her streets are thousands of acres of coal and iron, of very the richest quality. Colonel Wilder, of Ohio, is now producing as good an article of pig iron at fourteen to fifteen dollars per ton as Pittsburgh is furnishing for twenty-eight to thirty dollars per ton. The reason is that we have fire-clay, limestone, iron and coal, all in inexhaustible quantities; and lying side by side, we have the richest mineral deposits of iron and coal on the face of the globe; but the broad-gauge roads say, there let the coal and iron remain, and there they have remained. Right there in the midst of this rich field of mineral wealth, we buy all the iron used in all the various industrial arts, we buy our horse shoes and nails, everything in fact manufactured by iron: even the metalic coffin in which we are buried, and the spade and shovel with which our graves are dug.

We have never been able to develop these resources, and why? Our broad-gauge railways, in that section, have cost fully $40,000 per mile. The average of our roads in the Southern States — $32,000. We have but one means of development in the South is agriculture, the cultivation of cotton — and we have a sparse rural population, consequently business is very light. Broad-gauge roads are necessarily compelled to charge high rates — higher than the people are able to pay. In many parts of Georgia it would be impossible to build a three foot gauge, because a two is cheaper, and ample for the purposes, and furnishes the people with every needed facility. There was another fact to which he wished to call especial attention. Within the last year over ten thousand people have emigrated from Georgia to the north and north-west, from the fact that there were no railroad or telegraph facilities. It is a serious question, and we are deremined that every portion and part of our State shall have its road, whether it be a three foot or two foot, and to a great extent we must rely upon local and county subscriptions to build our lines. Hence we have decided to use a twenty and twenty-five pound rail, and some even as low as eighteen pound. Timber is abundant and cheap. An eight, and even a six-ton locomotive is ample for our business.

He wished to impress upon the minds of the southern people the fact that the future interest and future development of the South, depend more upon the adoption, and the successful adoption, of the narrow-gauge, than upon any other proposition or subject that has been submitted to us since the war. Then, instead of having an emigration from the South we would have an *immigration* of ten thousand a year into the South. In conclusion, he said they were looking with the greatest interest to roads like the Denver and Rio Grande, constructed in the South. We are extremly anxious that you don't make any mistake, and he asked them not to build a narrow-gauge road on broad-gauge principles, and to take care that they did not load it down with palace cars, so that it may be operated against us in the South.

The meeting was further addressed by W. S. Auchincloss, of Delaware, on narrow-gauge cars; D. E. Small, of Pennsylvania, on narrow-gauge cars; A. W. Small, of Pennsylvania, on narrow-gauge locomotives; G. A. Karweisse, of Kansas City, on narrow-gauge roads, and Col. W. C. Faulkner, on the subject of the construction of the Ripley and Gulf Railroad, of which he is President.

The Convention then adjourned to meet on Thursday, 20th inst., at 11 A. M.

St. Louis, June 20—11 A. M.

A CENTRAL COMMITTEE.

Mr. C. H. Howland said: The attendance has very agreeably surprised me, as well as many others. Those of us who have been advocating the narrow-gauge system have been working, to a very great extent, in a fog, so far as the idea of it being a pretty general favorite in the minds of the people is concerned. Its popularity has exceeded our expectations. I think it would be advisable to have some nucleus around which we can gather, and I propose a resolution appointing a Central Committee—one from each State represented—and to be composed of active advocates of the system, upon whom the public can call for statistics and other information upon the subject.

He moved the adoption of the following:

Resolved, That in view of the necessity of concert of action and the dissemination of information on the construction of narrow gauge roads, a *National Central Executive Committee* be appointed consisting of 13 persons, to whom all applications may be made for information, and all statistics bearing on the question be forwarded. Said committee to have full authority to call the narrow-gauge advocates into convention at such times as they may think proper, and take such action as they may deem advisable to advance the general interests of the narrow-gauge movement.

At a subsequent stage of the meeting the following were appointed:

C. H. Howland, St. Louis; W. H. Greenwood, Denver, Col.; E. Hulbert, Atlanta, Ga.; W. C. Faulkner, Ripley, Miss.; P. B. Borst, Luray, Va.; W. S. Auchincloss, Wilmington, Del.; E. Wragge, Toronto, Can.; B. E. Wells, Opelika, Ala.; G. M. Priest, Henderson, Ky.; W. J. Sykes, Memphis, Tenn.; S. Staats Taylor, Cairo, Ills.; L. A. Grant, Des Moines, Ia.; D. E. Small, York, Penn.

THE THIRD RAIL QUESTION.

Mr. L. A. Grant, of Iowa, asked the opinion of the delegates on the subject of a third rail on the standard broad-gauge track, whether it is practical, and if so, whether admissible. It had been suggested to him that the expense of putting on a third rail on a broad-gauge would be very much less than the construction of an independent road. On the other hand, it was maintained that the expense would not be so very much less, because it would be necessary to put down a rail as heavy as that employed by the broad-gauge—that there were no means of hoisting a small rail so as to make it practicable. Mr. E. Wragge, of the T., G. & B., and Tor. & Nipissing Roads, spoke of eighteen miles of his road which had been built for its convenience on the Grand Trunk, and which had cost them $27,000. Col. E. Hulbert, of Georgia, said one ad vantage of the third rail was that one could not run mixed trains. Two rails might be placed inside of the broad-gauge, the narrow gauge using the same bed, but the difficulty was the narrow-gauge had to be governed by the same schedule.

CAPACITY OF GAUGES.

He spoke at some length of the objection made to establishing narrow-gauge roads. One mode of objection was to quote some broad-gauge road which was at times blocked with a rush of business, and then ask how could a narrow gauge take its place. The best reply was an explanation. He had never seen a broad-gauge road taxed to its utmost capacity. When they were blocked with business it was because they simply lacked rolling stock. A three feet gauge road would have a capacity, if properly equipped, to do more business than is actually done by any broad-gauge road in the United States. Col. Hulbert argued that notwithstanding the transfer from a narrow-gauge, there was still a great advantage in favor of narrow-gauge roads, because of the high rates which the former were compelled to charge. Where narrow-gauge would develop, they often retard the advancement of a country.

NARROW-GAUGE IN VIRGINIA.

On invitation, Hon. P. B. Borst, of Virginia, addressed the convention:

MR. PRESIDENT AND GENTLEMEN:

We are truly fortunate in selecting St. Louis as the place to hold our first national convention. St. Louis is not old in years, but it is old in wealth and population. We have selected the proper place to hold this first convention because she has indorsed the principle,—the system. Is that all? not by any means; but we expect liberal aid in the construction of other projected roads to this point. I see my friend here from Mississippi. (Col. W. C. Faulkner). He is building a road from Ripley, Mississippi, to connect at Cairo with the St. Louis and Cairo Road, which is almost completed. Beyond the city limits we find the running stock of a road which will be as perfect as any road ever constructed upon this continent. Look at the Denver and Rio Grande, the St. Louis and Cairo—and there are a dozen other roads, I say, pointing to St. Louis as the common center. The object of this convention was to show the practicability and feasibility of narrow-gauge roads, how they could be constructed, how maintained, etc., etc. He wished to allude to some of the points presented for consideration. He took up first the

WANT OF RAILROAD FACILITIES

and spoke of the gigantic growth of St. Louis, Chicago, Cincinnati, Baltimore and New York. Three-fourths of it had been brought about by this agency. Do we want more railroad facilities? The North is well supplied. But we turn to the South, and we find there a desolated country, without railroad facilities, without actual means of transporting their rich commerce and mineral wealth to the markets of the world. Passing around to the Southwest, we see a country uninhabited except by the Indians; to the Northwest we find a vast expanse uninhabited, uncultivated, and with vast mineral wealth undeveloped. In the West, South and Northwest there is room for far more railroad facilities than we now have, and the interests of the government and of the people demand the construction of more roads. How are you going to supply the demand? We will supply it with this new system of narrow-gauge railroads that are now being projected and will soon cover the continent—the road that will furnish low freights. We have hit upon the proper way of giving railroad facilities to this continent.

Passing on to the second point suggested for discussion, we come to the question of the

COST OF THE TWO SYSTEMS.

He instanced the road they were trying to build from Richmond, Virginia, to St. Louis—Washington, Cincinnati and St. Louis road. The narrow-gauge system received its impetus in the hills of Wales. There is where it was conceived and practically developed. The entire system grew from a little tramway first used in bringing slate from the mountains, and which grew to be a passenger, and then to a general freight road. In 1870 it carried 10.000 tons of freight per mile, and about 8,000 passengers. There never had been any accidents upon that road, and in regard to the question of gain, *it declared in* 1870, *upon the capital stock of the company, the enormous dividend of forty per cent.*

WASHINGTON, CINCINNATI AND ST. LOUIS.

Mr. Borst then returned to this enterprise, which he represented. It was only organized a few days ago, but enough had been already subscribed to build the road through Virginia. The capital stock was $15,000,000. The road begins at Richmond, crosses the State to Mt. Pleasant, Ohio; passes thence to Cincinnati, and traversing a line between the Ohio river and the Terre Haute road, runs to St. Louis. Mr. Borst described the rich mineral and coal lands at the starting point of the road. In Pocahontas county is a mountain of ore that yields eighty-three per cent. of pure ore. In close proximity are coal veins, richer and purer than any found in Pennsylvania. The coal is located above water in the mountains. It was necessary, to get it, only to go into the sides of the mountains. In other counties were beds of plaster. In others along the route there were marble quarries of fine quality. Then there were rich salt springs and oil wells. In other sections the road would pass through a rich agricultural region. Twenty thousand acres of these rich mineral lands have already been subscribed, and 200,000 more are promised. These coal-fields are 100 miles nearer to tide-water than the coal-fields of Pennsylvania. Its entire length is 830 miles; it is in a direct line from Richmond, which would give it Norfolk, with its magnificent harbor, as an outlet on the seaboard. When they had gathered up their subscriptions along the line, which were sufficient to grade the road, they proposed to assume a moderate debt, sufficient to pay for the superstructure and the rolling stock. When completed, it would be 150 miles shorter to New York than by the New York Central or Erie. The only remaining question was, "Would it pay?" The cost of construction to St. Louis would be only $13,460 per mile, and he maintained that the branch to Washington and other points, which would cost but $15,000 per mile, would pay a dividend of twenty-five per cent. per year to create a sinking fund with which to extinguish the principal of its bonded debt.

Mr. C. H. Howland, of St. Louis, offered the following:

Resolved, That in the opinion of this Convention, it is highly important to have constructed a grand central narrow-gauge line from tide-water to the interior of the continent, that the various narrow-gauge railways now constructing in the Mississippi valley may have continuous connection with the seaboard.

Which was adopted.

BREAKING BULK.

Col. Hulbert was asked what would be the disadvantages of a narrow-gauge, by being compelled to break the bulk to a broad gauge. Col. H. replied that the cost of transporting freight in the South over a narrow-gauge was one cent per ton per mile, and on a broad-gauge one and one-half cents per ton. Take a road one hundred miles in length, and the freight of the one would be $1.50, and of the other $1 per ton for the entire distance. The expense of breaking bulk where the facilities for transfer were good was about five cents per ton. He would undertake to transfer it from one car to another for that. Now suppose it costs ten cents per ton, and suppose the freight be broken at each end of a narrow-gauge road one hundred miles in length, there is still left a difference of thirty cents in favor of the narrow-gauge.

Col. Hulbert gave interesting facts in relation to the

DEAD WEIGHT ON BROAD-GAUGE ROADS.

In the Southern States on passenger trains the average dead weight on broad-gauge roads was 5,000 pounds for each passenger. In the Northern States on those roads over which there is a good deal of travel it was from 3,000 to 4,000 pounds for each passenger. The ordinary box cars of a broad-gauge road weigh 20,000 pounds, and an engine twenty-five tons, while on a narrow-gauge the weight of an engine and cars is less than one-half. A loaded train on a narrow gauge would be no heavier than an empty train on a broad-gauge. The cost of keeping a broad-gauge up is largely in excess of that of the narrow-gauge.

The Convention then took a recess until 3 o'clock P. M.

3 O'CLOCK P. M.

The Convention then assembled.

A telegram was received from the Division Superintendent of the Denver & Rio Grande Railroad, announcing the completion of that road to Pueblo, a distance of one hundred and twenty miles.

While waiting for the report of the Committee of Eleven, engaged in conversation upon various practical topics.

Mr. E. Wragge, of Toronto, Canada, then read the report of the Committee of Eleven on the Narrow-Gauge System. (This report will be found in the Appendix.)

Which was adopted and referred to the National Executive Committee for publication.

Mr. C. H. Howland offered the following:

Resolved, That the thanks of this Convention be tendered to Messrs. Laveille, Warner & Co., the proprietors of the Southern Hotel, for the use of the parlors of the hotel during the sitting of the Convention, and for their many courtesies to the Convention.

Which was adopted.

Resolutions of thanks were also tendered to the President and Secretary.

Convention then adjourned to meet at the call of the National Executive Committee.

ERASTUS WELLS, President.

LUTHER H. CONN, Secretary.

APPENDIX.

REPORT OF THE SPECIAL COMMITTEE OF ELEVEN.—FULL EXAMINATION OF THE QUESTIONS PROPOSED IN THE CALL.

MR. PRESIDENT :—

Your committee to whom was delegated the duty of preparing a Report upon the "peculiar merits and advantages of the Narrow-gauge Railway System," beg leave to recommend the adoption of the following resolution :

STANDARD NARROW-GAUGE.

Resolved, That having found the three feet gauge so numerously represented in this Convention, *they recommend that it be adopted as the Standard Narrow-Gauge by all roads where there are no particular reasons for adopting a less gauge.*

Because (1) a uniform gauge is very essential to the final success of the system ; and, (2). Because they believe, if it is adopted on all narrow-gauge roads, that it will not be many years before the three feet standard roads will have through connections North, East, South and West, with a better system of interchange of cars, and a less amount of transfer than there is now on the four feet eight and-a-half inch of the North, the five feet of the South, and other gauges now in operation.

They also recommend the adoption of twenty-four inches as the standard height for the center of draw-head above the rail.

In the call for the Convention, twelve points are suggested for discussion, in order to elicit the fullest information in regard to both the construction and the *practical operations* of the narrow-gauge.—Your committee have been unable to devote as much time to the consideration of the subject as its importance demands, but have touched upon them all, and in doing so have been careful to *understate* rather than overstate the capacity and numerous advantages of the new system.

I.—THE WANT OF RAILWAY FACILITIES

is acknowledged by all classes, and the valid reason why any locality is without the same, is simply a financial question. All sections of the country would be in possession of railway transportation, if they possessed the means, or could borrow the funds at a reasonable rate of interest; and your committee believe that any system which tends surely to that end, namely,—the sale of bonds at, or as near par as possible, and at the standard rate of interest is, and will be of vast benefit to the public; and as the narrow-gauge will do all the business of any section of the country *with a much less bonded debt,* it tends to give a much better security to the bonds and stock of the roads, making a better sale for the same, and in that way furnishing many feeders to our present through lines, which would not otherwise be constructed, and soon connecting local lines so as to make new through lines of the three feet guage, North and South as well as East and West.

II.—COMPARATIVE COST OF THE OLD AND NEW SYSTEMS.

Taking what are called first-class roads, equipped to do the business of the various localities through which they run, your committee feel justified in the following conclusions:

(1). That, in very

ROUGH, MOUNTAINOUS COUNTRIES.

where the transportation of heavy ores, such as gold, silver, copper and other minerals in bulk, before reduced, so as to collect the same at the various smelting works, with the coal, wood and fluxes used in the reduction and manufacture of the same, and where it is not necessary to run fast or time trains—*the cost of construction of a three feet gauge road will not be over one-fifth of such roads as the Erie, Pennsylvania Central, and Baltimore & Ohio;* and that the capacity of the cheap road can at any time be increased by capital so as to do all the business, for all time to come; *thereby saving a large amount in first cost and interest on the same, which is the strongest possible recommendation for capital to invest in narrow-gauge cheap roads, rather than in the expensive broad-gauge.* (2). That in the

BROKEN, ROLLING COUNTRY,

where most of our roads are constructed, the saving will be about as one to two: namely, that the narrow-gauge will cost about *one-half* as much as the present broad-gauges have cost. The Denver & Rio Grande narrow-gauge railway has cost $13,500 per mile equipped. Your committee would respectfully ask, and earnestly urge all parties interested in the construction of railways, that this part of their report be thoroughly investigated; and that the question of *what the present broad-gauges have cost,* be examined as carefully by narrow-gauge advocates, as has the question of what their roads do, and will cost, by the friends of the broad-gauge—not forgetting to look into what broad-gauge advocates say they can do in the way of reduction of dead weight, but which none of them can afford to attempt, on account of the vast amount of capital invested. (3). That in the

SLIGHTLY UNDULATING PRAIRIE OR PLAINS COUNTRY

the cost of construction of a first class narrow-gauge passenger road, with the equipments suitable for a large freight as well as passenger business, will not exceed three-fifths of what a broad-gauge would cost with what is now called first-class equipment and road bed; and that the Denver & Rio Grande railway practically and fully demonstrates that the *cost* is only about *one-half* that of the broad-gauge, and that the *safety* and real comforts are fully equal to those on the great government roads, viz: the Union Pacific, Kansas Pacific, and the Central Pacific.

III.—OUR MEANS OF CONSTRUCTING THE BROAD-GAUGE, AS COMPARED WITH THE NARROW-GAUGE.

Railway officials are so well advised in this question, that it is only necessary to say, that the obtaining of a sufficient amount of money to construct a road on a cash basis is the only real difficulty to be overcome. *It is a self-evident fact that it is very much easier to obtain* $10,000 *per mile than it is* $30,000. It cannot be denied that we have numerous localities, North, East, South and West, in which railway facilities are imperatively demanded, nor will it be denied that in many instances it would be impossible to obtain the means to construct them broad-gauge; or if able to do so, that when done they would not command sufficient business to sustain them. Their excessive cost, entirely disproportioned to their light business, would necessarily compel them to charge high rates in order to pay operating expenses, and interest account, and thus *retard,* rather than stimulate development. Your committee *are unable to see the propriety of thus unnecessarily tax-*

ing the industries of the country especially when the required facilities may be obtained by the adoption of the narrow-gauge at one-half the cost, thereby placing it within the means of the localities referred to, not only to provide themselves with railways, but with low rates. Admitting that $10,000 per mile will accomplish the desired object, your committee *are unable to see the economy of investing $20,000 per mile and thereby incurring the entailment of high rates for all time.*

As to

NARROW-GAUGE SUPPLIES,

such as rail, locomotives, cars, etc., the construction of the Denver & Rio Grande, as well as many other roads from twenty to one hundred and fifty miles in length, now fast being completed, and even more rapidly than most broad-gauge roads have been constructed,—shows most conclusively that American skill, ingenuity and energy has been equal to the emergency. In conclusion upon this point we beg leave to remark that we are clearly of the opinion that an impartial and thorough examination of the subject, cannot fail to convince the most skeptical of the great advantage in favor of the narrow-gauge, in *first cost, and the consequent money saving results to be obtained thereby in the more rapid development of our resources.*

IV.—THE COMPARATIVE COST OF OPERATING THE TWO GAUGES.

Your committee cannot find that it has ever been claimed by the broad-gauge advocates that their system can be operated for less than can the narrow in any case; while the opinion and practice of all roads prove when the business exceeds a certain extent, that it is cheaper to construct a double track, the interest on the same to be added to the operating expenses.—It should be borne in mind that the double track narrow-gauge will not cost as much as the broad-gauge single track; hence the narrow can under all circumstances furnish *cheaper transportation* than the broad.—In seeking to develop our resources we must not lose sight of the fact that *low rates* of transportation will accomplish the desired end much more rapidly than high rates which frequently prevent and in all cases *retard development.*—In examining the question of the comparative cost of operating the two systems, we will first show the

DIFFERENCE IN THE WEIGHT OF THE ROLLING STOCK AND MACHINERY,

and then trace the effects produced in each case to a final result.

The following table shows the proportions of paying and dead weight in the cars of the two gauges when loaded to their full capacity:

PASSENGER CARS.

GAUGE.	WEIGHT OF CARS IN POUNDS.	NO. PASSENGERS—FULL LOAD.	LBS. DEAD WGT. PER PASSENGER
Broad - - - - - - -	38,000	56	678
Narrow - - - - -	15,000	36	416
	23,000	20	262

Pounds dead weight per passenger carred on roads in Massachusetts and New York, in 1870:

Massachusetts - - - - - - - - - -	1,250
New York - - - - - - - - - - -	2,784

In this case the narrow-gauge coach, weight 15,000 pounds, carries, when full, 36 passengers, with a dead weight of 15,000 divided by 36=416 pounds per passenger, while the broad-gauge coach, capacity 56 passengers, weighs an average of nineteen tons, giving a dead weight of 38,000 divided by 56=678 pounds; a difference of 262 pounds per head in favor of the narrow-gauge.

But the coaches seldom run full, in which case the advantage will be still greater in favor of the narrow-gauge. To test the comparison still further, we will suppose that we have thirty-eight passengers, two more than the small coach will accommodate, making it necessary to put on the second one.

In this case we will have two narrow-gauge coaches, weighing thirty thousand pounds, or thirty thousand divided by 38=789; while by the broad-gauge we have thirty-eight thousand divided by 38 = 1,000 pounds dead weight per passenger, or a difference of two hundred and eleven pounds per head in favor of narrow-gauge.

But let us apply still another test. We will suppose that we have two narrow-gauge car loads, seventy-two passengers, or sixteen more than can be accommodated with one broad-gauge coach, necessitating the use of a second one. The account will then stand as follows: two narrow-gauge coaches, seventy-two passengers, thirty-thousand divided by 72=416 pounds per passenger;

while by the broad-gauge it will be two coaches, seventy-six thousand pounds divided by 72 = 1055 pounds per passenger, *or a total of forty-six thousand pounds, or twenty-three tons, saving in dead weight in favor of the narrow-gauge in only two cars.*

The dead weight per passenger, on the New York roads for 1870, was 2,748 pounds, exclusive of baggage, with an average of thirteen passengers per car. On a large majority of roads, the average dead weight is much greater. The passenger coaches, then, on the New York roads, run about one-fourth full. For the purpose of a further comparison, we will assume that our broad gauge railways average the same number (thirteen) per car. On this basis,

THE TABLE OF PAYING LOADS AND DEAD WEIGHTS

is arranged thus:

Kind of Traffic	Gauge.	No. Passengers per Car.	Weight of Car in Pounds.	Total Paying Load in Lbs.	DeadWeight pr Pass'ger per lb	Gross load in Pounds.
Passenger,	Broad,	13	38,000	1,950	2,923	39,950
do	Narrow,	13	15,000	1,950	1,153	16,950
Difference, - -	- - - - - -	- -	23,000	- -	1,770	23,000

A difference of twenty-three thousand pounds, or eleven and a half tons, in favor of the narrow-gauge, or 1,770 pounds per head for each passenger.

Assuming that the weight of the broad-gauge car to be only fifteen tons, or thirty thousand pounds, the difference in favor of the narrow-gauge car will still be fifteen thousand pounds, or two thousand three hundred and eight pounds per head for each passenger, as against one thousand one hundred and fifty-three pounds per head, by the narrow-gauge.

Of course *the traveling public pays for this excess of unnecessary dead weight, amounting to many millions of dollars per annum.*

We will now compare the two gauges, in reference to the when the cars are loaded to their capacity.

Gauge.	Weight of Box Cars in Pounds.	Capacity of Box Cars in Pounds.
Broad, - - - - -	18.500	20.000
Narrow, - - - - -	8,000	16,000
	10,500	4.000

Average Pounds of Dead Weight to one ton paying freight carried on Railways in Massachusetts and New York in 1870:

Massachusetts, - - - -	3,136	New York, - - - -	3,091

The average weight of modern broad-gauge cars is twenty thousand pounds, capacity twenty thousand pounds. The average weight of Southern broad-gauge cars, may be put down at eighteen thousand five hundred pounds, capacity sixteen thousand pounds. In the table we have taken the lowest dead weight, and the highest capacity, as we prefer to over estimate the capacity of broad-gauge, rather than under estimate it. While the dead weight carried by the railways of Massachusetts and New York, is enormously disproportioned to the paying weight, it should be borne in mind that the average dead weight, carried by our railways generally, will greatly exceed that of the States referred to. If Massachusetts hauls 3,136 pounds of dead weight, to transport one ton of paying freight (not passengers), and New York 3.091 pounds, what may we expect is the average in the agricultural districts of the South-west and North-west?

The proportion of dead weight to paying freight, on the Southern railways, is even much greater than it is in the West and North-west. In a word their railways have a capacity far in excess of the business of that section, entailing high rates upon them, and thus retarding development, which cheap narrow-gauge roads with their low rates would stimulate into great activity. It will be observed that the average of freight carried, per car, by Massachusetts roads is about one-third the capacity of the narrow-gauge box car.

WAY FREIGHT.

In transporting quantities less than a full car load, the narrow-gauge cars have immensely the advantage. Cars carrying through freight may be loaded, very generally, to their full capacity, but the average net car loads are brought by the necessity for dropping cars from the trains at turn-outs, along the route with way or local freights, frequently very small in proportion to the full car load. The following table shows the amount of dead weight per ton, in pounds, by the two systems, when the shipment of freight to a way station is not an even car load. The figures in the heading show the amount of supposed shipment in tons.

DEAD WEIGHT PER TON IN POUNDS ON THE TWO GAUGES.

GAUGE.	Number of cars to carry shipm't.	TONS.										
		1	2	3	4	5	6	7	8	9	10	11
		DEAD WEIGHTS.										
Broad,	1	18,500	9,250	6,166	4,625	3,700	3,083	2,642	2,312	2,055	1,850	
"	2											3,363
Narrow,	1	8,000	4,000	2,666	2,000	1,600	1,333	1,142	1,000			
"	2									1,777	1,600	1,454
Difference in favor of narrow-gauge		10,500	5,250	3,500	2,500	2,100	1,750	1,500	1,312	278	250	1,909

This table shows that if it is necessary to drop cars with nine tons of freight, at a way station,--this being an amount which is one ton over a car load for the narrow-gauge, and which renders necessary the use of two cars at the utmost disadvantage,—the dead weight is even then only 1,777 pounds per ton, and still 278 pounds less than the broad-gauge. These *operative* comparisons would seem to be sufficient to settle the question so far as the *economy* of the narrow-gauge is concerned; but it may be well to look into the question of the reduced.

WEAR AND TEAR,

in consequence of the use of light machinery and rolling stock. If we assume that the repairs of machinery and rolling stock are in direct ratio to its cost, the reduction for the narrow-gauge would be about fifty per cent., which is the difference in the first cost.

COMPARATIVE STRENGTH OF ROLLING STOCK.

The expenditure of power and ordinary repairs should be held strictly correlative; and yet there can be no doubt but that all the parts of the narrow-gauge machinery and rolling stock, being relatively stronger, and the shocks to which they are exposed being so much lighter, both cars and locomotives will run with much less repairs than has been generally estimated. Narrow-gauge locomotives weigh from six to eighteen tons, depending upon the nature of the service they have to perform. The following table gives the principal dimensions and weights of various patterns and sizes of narrow-gauge locomotives, together with the loads they will haul on a straight track in good condition:

DIMENSIONS, WEIGHTS AND LOADS OF NARROW-GAUGE LOCOMOTIVES.

KIND OF LOCOMOTIVE	Cylinders.		Diameter of drivers.	Weight in working order.			Load in gross, cars and lading.			
	Diam.	Str'ke		Total.	On drivers.	On each pr of drivers.	On a level.	On a 40 ft. grade.	On an 80 ft. grade.	On a 100 ft. grade.
Class 1.	9	12	30	18.000	18,000	9.000	390	120	70	55
Four wheels connected	9	16	36	22,000	22.000	11.000	490	150	85	70
tank locomotive.	10	16	36 to 40	26,000	26,000	13,000	590	180	105	85
Class 2.	9	12	30	16.000	16,000	8,000	385	115	65	50
Four wheels connected	9	16	36	20,000	20,000	10,000	480	140	75	60
with separate tender.	10	16	36 to 40	24,000	24.000	12,000	580	170	95	75
Class 3.	10	16	36	28,000	28,000	9.383	615	185	105	85
Six wheels connected	11	16	36	33.000	33.000	11,000	740	225	130	105
tank locomotive.	12	16	36 to 40	38,000	38,000	12,666	860	265	150	125
Class 4.	10	16	36	25,000	25,000	8,333	605	175	95	75
Six wheels connected	11	16	36	30,000	30,000	10,000	730	215	120	95
with separate tender.	12	16	36 to 40	35,000	35.000	11.666	850	255	140	115

Here let us call attention to a matter that bears directly upon the question of "wear and tear" giving a table showing the weight on each wheel of ordinary trains of the two gauges, and the momentum with which the wheels will strike the irregularities in the track.

WEIGHT ON WHEELS—THEIR MOMENTUM.

[Passenger Trains—Speed Twenty-five Miles per Hour.]

	5 Feet Gauge.		3 Feet Gauge.	
	Weight on single wheel pounds:	Momentum. Pounds.	Weight on single wheel Pounds.	Momentum. Pounds.
Engine Driver,	8,000	288,000	6,250	225,000
Engine Truck,	5,000	180,000	2,500	90,000
Tender,	7,650	174,000	3,500	126,000
Baggage Car,	4.000	144,000	3,000	108,000
Passenger Car,	4,760	171,360	1,780	64,080

The ends of the rails are beaten to pieces, the surface abraded, the ties splintered, the fibre of the wood cut under the iron, weak joints rapidly made worse, so that each succeeding wheel falls with an increasing force upon the ends of the yielding rails, by the tremendous forces developed by the passage of these enormous weights at high speed.—The lightest broad-gauge coach weighs about sixteen tons, or 32,000 pounds empty, and hammers the rail joints with 4,000 pounds on each wheel. When loaded and driven over the rails at twenty-five or thirty miles per hour, the weight of the blow is enormous, and terribly destructive to the superstructure, crushing out the best rail in five or six years. The passenger car of a three feet gauge would only hammer the rail with 1,500 pounds per wheel. The same truth applies to locomotives. A thirty ton locomotive, and its loaded tender, weighing about seventeen tons, or a total of forty-seven tons, will exert a pressure of nearly six tons on each driving wheel. When driven at a high speed, the strain upon the track is terribly destructive.

The "Fairlie" engine, constructed for narrow-gauge lines, bears its whole load, including wood and water, on the driving wheels, thus utilizing the whole weight in the work of hauling the train.

Instead of an engine carrying forty-seven to fifty tons to obtain the power of twenty, we have an engine weighing twenty tons and no more; and this load distributed over eight wheels, with a pressure of two and one-half tons per wheel, instead of nearly six tons, as with the broad-gauge. The action upon the rolling stock is the same as upon the track. The wheel receives a blow of precisely the same weight as that which it administers to the rail at a low joint, and the shock is transmitted to the axle, except what is taken up by the springs, and the yielding of the parts of the whole structure of the engine or car. The saving of dead weight transported is so much saved from the grand total of this destructive agency; and, by the reduced weight upon each wheel, no single blow of such enormous force can be given on the narrow-gauge. We leave this point with a single illustration, showing the total of the forces expended upon a defective joint on one side of the track, by the passage of a train of fifty passengers, on either gauge. The joint is supposed to have yielded, so that the wheels fall into it with a perceptible shock. In an example, selected for calculation, it results that the wide-gauge train will have inflicted a series of blows, amounting, in the aggregate, to 6,891,840 pounds, while the narrow train will have expended a force amounting to only 3,248,640 lbs. Fuel, oil and waste are also reduced in cost in proportion to the power developed. The list of employes, cost of general superintendence, office expenses, loss and damage are not estimated. The percentage of saving in the different departments may be estimated as follows:

CLASSIFICATION OF EXPENSES.

	Percentage of whole Operating Expenses	Percentage saved by Narrow-Gauge
Maintenance of Roadway—		
Repairs road-beds	.166	.055
Cost of iron for renewals	.129	.065
Repairs building fences, etc	.037	
Taxes	.038	
Repairs of machinery and cars	.20	.070
Operating—		
Office expenses, agencies and employes on trains and at stations	123	
Fuel, oil and waste	.125	.041
Loss and damages, to goods and persons, general superintendence, &c.	.030	
Contingencies	.052	.017
Total	100 p.c.	.248 p. c.

The narrow-gauge may be operated for about twenty-five per cent. less than the broad-gauge, and where the proportion of expenses to gross receipts is seventy per cent., the ratio of the narrow-gauge expenses to receipts would be fifty-two and one-half per cent., and with strict economy probably as low as forty-five. The operation of the Denver & Rio Grande railway fully demonstrates the correctness of the position taken by your Committee on this important point. The expenditure of power stands in the relation of about thirty-five to fifty-four in freight and eleven to thirty in passenger traffic.

V.—CAN NARROW-GAUGE LOCOMOTIVES BE CONSTRUCTED OF SUFFICIENT POWER AND SPEED TO ANSWER THE GENERAL REQUIREMENTS?

Your Committee most unhesitatingly answer yes; and for the following reasons:

PRACTICAL FACTS.

(1). Because they are doing it daily, and any one who wishes to investigate the question has only to visit the roads where they are in use and witness their performance. (2). From the fact that the great standard-gauge roads are taking their heaviest freight engines off their lines, as fast as it can be done with economy, or as fast as they are worn out, preferring to run more trains rather than the extra heavy ones, because the breakage of draft irons, links, bumpers, and the fearfully costly lamination of the rail, etc., etc., amounts to more than the cost of the additional men and trains. (3). That by adopting the proper form of construction, the engines can have sufficient power to handle any number of cars that can be prudently and economically run together in one train, and that such a train can be handled with as much safety on the narrow as on the broad-gauge: while the proportion of dead weight being much less, the same number of train men will handle more tons of paying freight, on the narrow, than on the broad-gauge, when worked up to the same tonnage. (4). All narrow as well as broad-gauge advocates acknowledge that trains can and are run too fast for the best interests of the roads and the public, and that it taxes them far beyond the bounds of economy to run fast trains. (5). That there is no difficulty in making as fast time with the narrow-gauge locomotive as the great majority of the broad-gauge road make, which is all the public demands; and in advocating economy in this particular, that we represent the true interests of the public. (6). That the locomotives of the Denver & Rio Grande railway, freight and passenger, are giving entire satisfaction both as to speed and power.

RESULTS ON DENVER AND RIO GRANDE.

A seventeen-ton freight locomotive on that road has hauled a train of twenty-four cars with ease up a grade seven miles long, averaging forty feet to the mile: four miles of the same having a grade of seventy-five feet per mile.

GROSS WEIGHT OF TRAIN.

Four empty eight-wheeled box cars, 8,000 pounds each - - - - - - - - - - -		32,660
Twelve empty eight-wheeled platform cars, 6,000 pounds each - - - - - - - -		72,000
Eight loaded eight-wheeled platform cars, 6,000 pounds each - - - - - - - -	48,000	
And load on same, 16,000 pounds each - - -	128,000	176,000
		280,000

pounds, or 140 tons; and this over a new track. Add the weight of the locomotive, seventeen tons, and we have a total gross tonnage of 157 tons. A twelve-ton passenger locomotive has hauled the following load up the same grades on schedule time, viz.: fifteen miles per hour:

Five platform cars, 6,000 pounds each - - - -	30,000
And load (rail) on same, 16,000 pounds each - -	80,000
Total - - - - - - - - - - -	110,000

pounds, or fifty-five tons. Add weight of locomotive, and we have a total of sixty-seven tons. But a still more remarkable performance was that of one of its passenger locomotives, *that ran* 181 *miles with only* 2,340 *pounds of coal*, hauling the usual train of one baggage car and two coaches. Of this distance, 102 *miles were run up an average grade of forty feet per mile, and eight miles of seventy-five feet per mile.* The passenger trains on that road have frequently been driven at a speed of thirty miles per hour with entire safety, and with less oscillating motion than is observable on broad-gauge roads newly constructed. The construction and practical operations of the Denver & Rio Grande Narrow-Gauge Railway have been carefully examined by experts, and among them numerous broad-gauge advocates, who all agree that it is a complete success, and that the narrow-gauge locomotive *has* "sufficient power and speed to answer the general requirements."

VI.—CAN THE PASSENGER COACHES BE MADE SAFE, COMFORTABLE, AND POPULAR WITH THE TRAVELING PUBLIC?

The passenger coaches of the European and American narrow-gauge railways are admirably adapted to the respective gauges, of varying proportions and capacity; all agreeing in the most important point, namely: *that the proportion of dead weight hauled for each passenger is very much less than the broad-gauge.*

DETAILS OF PASSENGER CARS.

The first-class narrow-gauge coaches constructed by Messrs. Jackson & Sharp, Wilmington, Delaware, and in use on the Denver & Rio Grande Railway, are forty feet long, over all, seven feet wide inside, seven feet six inches high; with two four-wheeled trucks, wheels twenty-four inches in diameter, weight 12,000 lbs., and carry thirty-six passengers each. The sills are only twenty-seven inches above the rail, making the centre of gravity very low; hence the cars ride exceedingly steady, and with less lateral or oscillating motion than is usually observable upon the broad-gauge. The seats are arranged, double on one side, and single on the other one-half the length of the car, having the double seats on the right and the other half having them on the left, so as to distribute the weight equally. The single seats are nineteen inches wide or long; the double seats thirty-six inches; the aisle seventeen inches. If found desirable, there can be no serious objection to increasing the width of the car to eight feet, making the single seat twenty-two inches, the double seat thirty-nine inches, and the aisle twenty-three inches. These cars are finished in the best style; the wood work, the upholstery, decorations, and the whole arrangements being strictly first-class. For one to enter these cars is to be convinced that the traveler need have no apprehension as to his safety or comfort. In a word, your committee find that it is the opinion of those best informed, that they furnish every requisite called for by the first-class coach. While they will not furnish four seats to a passenger *who pays only for one*, they will furnish more passengers with a *preference* of seats than the broad-gauge double seats do, while the seats are in every respect as comfortable. The cars being smaller, railway officials can equalize the seats to the number of passengers much better than with the broad-gauge, thereby saving largely in dead weight, wear and tear, and the consequent cost of maintenance. Sleeping coaches with a single berth on each side, can be constructed so as to be as comfortable as those now in use, and at the same time have the ratio of dead weight very much in favor of the narrow-gauge. In view of the *practical* facts enumerated, your committee unhesitatingly affirm that the "narrow-gauge passenger coach" is as "safe and comfortable" as the broad-gauge, and that this being the case, they will become "popular with the traveling public; especially as narrow-gauge railways from this small cost, can and will furnish lower rates of fare than the broad-gauge.

VII.—CAN FREIGHT CARS BE CONSTRUCTED OF CONVENIENT SIZE FOR THE TRANSPORTATION OF COTTON, LIVE STOCK AND GENERAL FREIGHTS?

The Denver & Rio Grande railway are now doing a general freight and passenger business, and are carrying live stock, wool, lumber, and in fact every class of freight; and their officers give it as their unreserved opinion, founded upon actual experience, and which is concurred in by connecting roads, that they gain in every case where the size of the car comes in question and that in no case is the extra room of the broad-gauge car equal to the loss in dead weight. This applies to every class of cars on the roads with which the Denver & Rio Grande connects. They carry nine of the largest cattle in a car weighing less than 8,000 pounds, while the broad-gauge carry only fourteen of the same class in a car weighing from 18,000 to 20,000 pounds. The stock cars have four-wheeled trucks, are twenty-four feet long, the door being at the side, but near the end instead of the center, and on the opposite side of the other end. For heavy and valuable cattle, they have two gates in the car (which when not in use are folded back against the side of the car), which makes three rooms 6x8 feet, into which they put three head of stock each, giving a space of 2x8 feet to each head. The broad-gauge puts fourteen head of the same cattle into a twenty-eight feet car, which gives the Denver & Rio Grande and other narrow-gauge the same floor room that the broad-gauge has, and with much less dead weight.

COMPARATIVE DEAD WEIGHT IN THE TRANSPORTATION OF CATTLE BY THE TWO GAUGES.

Gauge	Weight of Car in pounds.	No. of Cattle per car.	Weight of Cattle in pounds	Gross Wei't of Loaded Cars.	Total Weight per head.
Broad - - -	18,000	14	19,600	37,600	1,285
Narrow - -	8,000	9	12,600	20,600	888
Dead weight in favor of narrow-gauge - - -					397

A difference of 397 pounds per head, 3,573 pounds per car load of nine head, and in a train of twenty cars 71,460 pounds, or thirty-five tons in favor of the narrow-gauge. Prominent stock men now say that they would prefer to send their stock to market in such cars as the Denver & Rio Grands furnish, because it does put so many together, and that the danger of cattle getting down is much less, while they can be fed and attended to much better. We will treat of the transportation of cotton under the next head.

VIII.—WHAT SAVING IN DEAD WEIGHT WILL THE NARROW-GAUGE EFFECT

Under this head your Committee desire to call attention to the fact as set forth by Mr. Fairlie, namely, that the East India narrow-gauge cotton car, weight 3,000 pounds, carries 10,800 pounds of cotton or paying freight, while the Southern broad-gauge box car, weight 18,500 pounds, carries only eight tons, or 16,000 pounds. Assuming that the cotton trains on our Southern railways average twenty-five cars per train, let us see how the narrow-gauge will compete with the broad-gauge in the transportation of the great staple of that section when moved in the standard English cotton car, and in order that we may be able to load the broad-gauge train to its full capacity, we will assume that the cotton is compressed:

COMPARISON OF COTTON TRAINS.

GAUGE.	Weight of single car in pounds.	Number of cars in train.	Total dead weight of cars in pounds.	Total paying weight in pounds.	Gross weight—broad-gauge train in pounds.	Gross weight—narrow-gauge train in pounds	Excess of dead weight on broad-gauge over the narrow-gauge in pounds.
Broad	18,500	25	462,500	400,000	862,500		
Narrow	3,000	37	111,000	400,000		511,000	
Difference in favor of narrow-gauge							351,500

A difference in favor of the narrow-gauge of 351,500 pounds, or 175 tons. We will now see how they compare when loaded with uncompressed cotton, which is the condition in which it is usually shipped. The common broad-gauge box car of the south has a floor area 27 by 8 feet=216 square feet, weighs 18,500 pounds, and carries twenty-four bales, weighing 450 pounds each. The paying freight carried per car is 10,800 pounds, and the dead weight 18,500 pounds. Or for each bale weighing 450 pounds, we have 770 pounds dead weight. The narrow-gauge box car has a floor area of 162 square feet, weighs 8,000 pounds, and will carry eighteen bales of cotton, weighing 8,100 pounds, or 444 pounds dead weight per bale, against 770 pounds by the broad-gauge.

COMPARISON OF TRAINS WITH UNCOMPRESSED COTTON.

GAUGE.	Weight of single car in pounds.	Number of cars in train.	Total dead weight of cars in pounds.	Total paying weight in pounds.	Gross weight broad-gauge train in lbs.	Gross weight narrow-gauge train in lbs.	Excess of dead weight on broad-gauge over the narrow-gauge in pounds.
Broad, -	18.500	25	462,500	270,000	732,500		
Narrow, -	8,000	34	272.000	275 400		547,400	
Dead weight in favor of narrow-gauge - -							190,500

A difference in favor of the narrow-gauge of 190,500 pounds, or ninety-five tons. We find that the narrow-gauge has largely the advantage in all cases, and that

THE NARROW-GAUGE EIGHT-WHEELED BOX CAR—Weight four tons, capacity eight tons, or a total of twelve tons, *weighs when loaded only two tons more than the heaviest broad-gauge box car when empty.*

THE NARROW-GAUGE EIGHT-WHEELED STOCK CAR—Weight four tons, capacity nine head (largest cattle), or 12,600 pounds, *weighs, when loaded, only* 600 *pounds more than the heaviest broad-gauge stock car, when empty.*

THE NARROW-GAUGE EIGHT-WHEELED PLATFORM CAR—Weight three tons, capacity eight tons, or a total of eleven tons, *weighs, when loaded, only two tons more than the heaviest broad-gauge platform car, when empty.*

THE NARROW-GAUGE EIGHT-WHEELED PASSENGER COACH—Weight six tons, capacity thirty-six passengers, or in round numbers, a total of nine tons, *weighs six tons less than the average of broad-gauge coaches, empty.*

In estimating the dead weight of narrow-gauge cars, we have taken the actual weight of those in daily use on the Denver & Rio Grande Railway.

Further argument on *this* point would seem unnecessary.

IX. — HOW WILL THE SAVING IN FIRST COST AND DEAD WEIGHT AFFECT THE RATES OF FREIGHT AND PASSAGE?

We have at this time about sixty thousand miles of broad-gauge railway in operation, in the United States.

COST OF THE PRESENT SYSTEM.

These Railways (according to "Poor's Railway Manual," a standard authority just published), have cost on an average fifty thousand dollars per mile, and in round numbers they represent an expenditure of three thousand million dollars.

Had we originally adopted the narrow-gauge, at one half the cost of the broad, the expenditure would have been only fifteen hundred million dollars, *leaving an equal amount for investment in manufactures or other means of development.*

Or with the three thousand million dollars, invested in narrow-gauge, *it would have given us two hundred thousand miles at fifteen thousand dollars per mile, or one hundred and fifty thousand miles at twenty thousand dollars per mile, in active operation to-day.*

It needs no argument to demonstrate if we had double the number of miles in operation that we now have, that our resources would be developed much more rapidly than is now being done. Neither does it need any argument to prove, had our railways cost us *only* from ten thousand dollars to twenty thousand dollars per mile, that it would have cost much less to have operated them; and that our general interests would have been advanced in a corresponding degree.

The cheaper the first cost of the road, machinery and rolling stock, provided they be ample for the business offering, the lower the rates, and the consequent rapid development of all interests. The great want of the age is cheaper transportation, and this we cannot have without cheaper railways.

COMPARATIVE COST OF TRANSPORTATION.

The average cost of transporting freight by the broad-gauge, may be estimated at one and a half cents per ton per mile, and on the narrow-gauge one cent. One ton transported two hundred miles, at one and a half cents, per ton per mile, will cost three dollars, and at one cent two dollars, a saving of one dollar, or thirty-three and a third per cent. in favor of the narrow-gauge. Estimating the cotton crop of the Southern States at four million bales per annum, and the average cost of transportation at three dollars per bale, we pay twelve million dollars freight per annum on this one product alone. Admitting that the cost of transportation by the narrow-gauge, would be one-third less than by the broad-gauge, it would effect a saving to the producers of four million dollars per annum; or, for a period of twenty-five years, one hundred million dollars, a sum sufficient to build ten thousand miles of narrow-gauge railway at ten thousand dollars per mile, or five thousand miles at twenty thousand dollars per mile. The East India Company, looking to the *extension*, of the cotton culture in their territory, have projected ten thousand miles of narrow-gauge railway; and that, too, in a country far more densely populated than ours, and offering a large general business. In addition to this, they are changing some of their broad-gauge into narrow-gauge, in order to reduce the cost of transportation on cotton, so as to be able to compete with us in the production of that staple. The East India cotton planter commands an almost unlimited supply of the *cheapest*, most patient and easily controlled labor in the world. This, with their system of cheap narrow-gauge railways, with its low rates of freight, makes them dangerous competitors; and it is a serious question, and one well worthy our earnest consideration, whether, with our dear labor and high broad-gauge rates, we can continue to maintain our supremacy in this branch of industry without cheaper transportation than we now have.

THE GREAT WANT OF THE WEST.

The great West and North-west, with their vast agricultural productions, demand *cheaper* transportation than the costly broad-gauge railways can possibly furnish them. They demand transportation so cheap, that points now so far distant as to be unable to ship their corn, and hence use it for fuel, will be able to enter the markets of the world with the products of their labor. The demand is a just one, and should be complied with; as it is a want that the great masses of the people are deeply interested in—that of cheap food. Your Committee might with propriety discuss this question at great length; but, it is *self-evident* that railways costing only from ten thousand dollars to twenty thousand dollars per mile, can work comparatively cheaper than those costing from twenty thousand dollars to sixty thousand dollars per mile, there can be no question of their effecting a *large saving* in both the "rates of freight and passage."

X.—BREAK OF CONNECTIONS.

The time of transferring freight need be very little, if any, greater than is now necessarilly consumed in the inspection and and repair of cars at intermediate points, which are sent over long lines. The shipper can well afford a slight delay, if thereby he saves largely in the cost of shipment. Experience has demonstrated the cost of transferring freight in Great Britain to be about two pence per ton. The cost on the Canaba frontier has been found to be, from many years experience, five cents per ton. Considering it is a question of cost, it will evidently bear heaviest upon through freight, which has to be changed at each end of the line, at a cost of five cents per ton, or a charge of ten cents per ton total. The average cost of transporting freight may be taken at one and a half cents per ton per mile, on the broad-gauge; but on the narrow-gauge, we find that we can transport *twenty-five per cent. cheaper in actual working expenses.* One ton transported two hundred miles, at one and a half cents, would cost three dollars, and a saving of twenty-five per cent. on this would be seventy-five cents; so that an expense of ten cents per ton may be incurred in transferring freight, and still leave a balance in favor of the narrow-gauge, or shipper, of sixty-five cents per ton, six dollars and fifty cents per car load of ten tons, or one hundred and sixty-two dollars and fifty cents for a train of twenty-five cars. Further argument is deemed unnecessary upon this point.

XI.—EXPERIENCE AND OPINIONS OF EXPERTS.

Reference has been already made to the practical workings of the Denver & Rio Grande Railway, as well as the convictions and opinions of its officers; all tending to show conclusively that the narrow-gauge has ample capacity for the business of any line on this continent. But we will quote the testimony of other professional authorities and experts. The annual report of

THE FESTINIOG,

narrow-gauge (one foot eleven and one-half inches) Railway, for 1869, shows that it transported 136,132 tons net, and 97,000 passengers that year. Gross tons hauled, exclusive of engines, 242,000.

The total receipts for the year 1869 were	£23,676
Expenditures	13,053
Net income	£10,623

or nearly fifty per cent.

IN NORWAY,

railways of the four feet eight and one-half inch, and of the three feet six inch gauges have been constructed by the same engineers, and worked by the same manager for the Government, and the following statistics are taken from the Government returns, showing the average from six years' experience.

	Gauge, Four feet 8 1-2 inches.	Gauge, Three feet six inches.	Difference in favor of the narrow-gauge.
Cost of construction per mile	26,343	17,143	9,200
Receipts per mile (alike)	27,600	27,600	
Maintenance per mile	7,173	6,565	608
Locomotive expenses per mile	9,426	5,760	3,666

Mr. Spooner, Engineer and Superintendent of the Festinoig Road, under date of December, 1870, gives the following opinions:

"From my experience in working the one foot eleven and one-half gauge, I deduce the following, to show the sufficiency of the two feet nine inch gauge:

1. That the cost in construction, in earthworks, bridges, tunnels, etc., depends on the gauge.
2. That the cost of maintenance of rolling stock will be low, consequent upon the small weight on each wheel
3. That a speed of forty miles per hour can be run with ease and safety."

Mr. Spooner's opinions are of special value, as the study of this subject has been his occupation during ten years; and, as his experience has been more full than that of any other person, so is his knowledge of the matter more profound. In June, 1869, the British Government appointed a commission of engineers and railway experts to consider what gauge should be adopted for the Indus Valley, and other projected railways in India. We quote from the majority report: "It is manifest that lines on this gauge (three feet six inches) are worked with as much convenience to the traffic as on any broader gauge, and vehicles may be used on this gauge which will *afford complete accommodations for all classes of passengers and goods traffic.*

The *experience* of the managers of the Denver & Rio Grande Railway fully sustains the correctness of the opinions expressed by Mr. Spooner and others.

XII.—THE NARROW-GAUGE AS COMPARED WITH THE BROAD-GAUGE AS THE MEANS OF DEVELOPMENT.

This is a question of vital importance, and one that affects all interests alike. This being the case, any system that will afford ample facilities for transportation at reduced rates, is a public blessing. The necessarily

HIGH RATES ENTAILED BY THE EXCESSIVE COST

of the broad-gauge, might have been avoided by the adoption of the narrow-gauge with its small cost, light operating expenses, and low rates. A most striking instance is that of the Southern States with their vast and inexhaustible supplies of coal and iron, unsurpassed for their purity and richness, and the ease and cheapness with which they can be mined and worked; but which, from the high broad-gauge rates of transportation, remain locked up in their hills and mountains. A cheap system of railways, with its low rates of freight, would have long since developed those interests, enriching that section, and adding vastly to the general wealth of the country. The great West and Northwest, with their broad prairies and vast plains, unequaled for their general productiveness and the ease with which they can be tilled, also feel the incubus of high rates of transportation entailed upon the products of their labor from the same cause. The reduction of rates which would follow the general introduction of the narrow-gauge system, would add millions of dollars per annum to their incomes, and at the same time largely benefit the consumer. General development can only be accomplished by an extended system of railways; quick development can only be attained by *cheap* transportation. We may therefore conclude that the narrow-gauge railway is by far the best means for a *general* and *quick* development of our resources, for the following reasons: (1). Costing only about *one-half* as much as the broad-gauge, it is within the means of all sections to build them, hence will enable them to avail themselves of railway facilities, where otherwise they will be compelled to dispense with them. (2). From their small cost, light operating expenses and small interest account, they will prove to be paying investments. (3). They will supply the great want of the age, cheap transportation. (4). Cheapening transportation, they will develop dormant interests more rapidly than our present costly structures, with their high rates, can possibly do. (5). Their general adoption in sections without railway facilities, will enhance the value of properties largely in excess of their cost. (6). Penetrating those sections, and rapidly developing their resources by low rates, they will bring a large new business to the broad-gauge roads, enabling them to reduce their rates, and thereby stimulate old and develop new interests. (7). A failure to adopt the narrow-gauge in the sections referred to, will necessarily *defer* the construction of railways until such time as their means will admit of the more costly broad-gauge, with its consequent high rates.

COMMITTEE

W. H Greenwood, Manager Denver & Rio Grande R., Denver, Col., Chairman.

E. Wragge, Chief Engineer Toronto, Grey & Bruce R., and Toronto & Nipissing R., Toronto, Canada.

T. H. Millington, Chief Engineer Memphis & Knoxville R. Co., Bolivar, Tenn.

A. W. Bell, of Porter, Bell & Co., Locomotive Builders, Pittsburgh, Penn.

D. E. Small, of Billmeyer & Small, Car Builders, York, Penn.

Wm. S. Auchincloss, Vice President Jackson & Sharp Company, Car Builders, Wilmington, Del.

Lucien Scott, Vice President Kansas Central R. Co., Leavenworth, Kansas.

Chas. H. Howland, Cairo & St. Louis R. Co., St. Louis, Mo.

W. Marsh Kasson, Manager St. Louis County R. Co.

P. B. Borst, President Washington, Cincinnati & St. Louis R. Co., Luray, Va.

E. Hulbert, President N. G. & N. C. R. Co., Atlanta, Ga.

MEMPHIS AND KNOXVILLE RAILROAD.

(NARROW-GAUGE.)

COMPARATIVE ESTIMATES OF THE COST OF ROAD-BED AND SUPERSTRUCTURE ON THE BROAD OR FIVE FEET GAUGE AND THE NARROW OR THREE FEET GAUGE.

Prepared from Actual Survey by Thos. H. Millington, Chief Engineer M. & K. R. R.

BOLIVAR, TENN., June 10, 1872.

The foregoing estimates of the cost of preparing the road-bed ready for the iron rails, with a gauge of *five feet* (the standard gauge of the South), and a gauge of *three feet*, have been made with great care from the final location surveys of the first Division of the MEMPHIS & KNOXVILLE RAILROAD, for which they were prepared. This road, when completed, will connect the cities of Memphis and Knoxville, in the State of Tennessee, by the shortest and most practicable route; passing through Somerville, Bolivar, Columbia, McMinnville and Kingston. On leaving Memphis, it is located on the table land between Wolf river Nonconnah creek, and Wolf and Loosahatchie rivers, and bisects the angle formed by the Memphis & Louisville and Memphis & Charleston railroads. The surface of the country is undulating, in places rolling and broken, but with no serious obstacles to the construction of a first class railroad at the average cost per mile of Southern roads. The road has been located as far as Bolivar, and with the view of bringing its cost as near as possible within the means of the people residing along the line, the Directory has adopted a gauge of THREE feet. It has not been found necessary to use a steeper gradient than sixty-six feet per mile, and this only for short distances. There are no curves of less than 1146 feet radius, and none of this radius on steeper grades than forty-six feet per mile.

Clearing and Grubbing—Where there is any, is heavy; as the timbered land is covered with a dense growth of white oak, poplar, gum and hickory of the finest quality.

Grading—Will be all earthwork, and easy to handle, as there is neither hard-pan, loose rock, nor solid rock found on that portion of the line for which these estimates are made. The average haul will not exceed four hundred feet.

Bridging—There will be one girder bridge of three spans of fifty feet each, over Wolf river. The piers will be piling.

Piling, Trestling and Log Culverts—In consequence of the soil on parts of the line being very liable to wash during heavy rains, piling will generally be used in preference to trestling, for which safe foundations would, in some places, be difficult to obtain. The unusually large quantity of piling is not attributable to the crossing of numerous water courses, or low and swampy lands, but to the fact that there is no rock suitable for building purposes found in any of the western counties of Tennessee, and consequently it is deemed more economical to use piling where culverts are requisite, leaving sufficient room for putting in masonry after the road is in operation, when building stone, hydraulic cement, and lime of excellent quality can be obtained, and hauled on the cars from the splendid quarries through which this road will pass near its crossing of the Tennessee river, to the site of the structure.

Prices—Of materials and labor are such as are now ruling in this section, and are fair and reasonable.

Engineering—Right of way, salaries, printing, stationery, etc., will cost as much on the narrow as on the broad-gauge; at least, such is my experiance with the survey.

Superstructure—The average weight of rail per yard on Southern roads is about sixty pounds, and of engines about twenty-five tons. As it is not intended to run engines of greater weight than fifteen tons over the Memphis and Knoxville road, I have estimated the rails at thirty pounds per yard, which I think will be a fair comparative estimate.

With the view of contributing a few *facts* with regard to the comparative cost of broad and narrow-gauge railroads in West Tennessee, even at the risk of tediousness, I herewith submit the estimates in detail, so as to show the comparison of each particular kind of work, or material used. The saving in favor of the three feet, or "narrow-gauge," is very great; amounting to $227,136 00 for thirty miles of road-bed and superstructure. There will doubtless be some saving in the cost of rolling stock and equipment, but as this is controlled more by the amount of traffic the road has to perform, than the gauge, I have not estimated it. Had this line been through a mountainous country, with heavy rock excavations, the narrow-gauge would have effected a much greater saving, than that above stated, which, though for a comparatively level country, amounts to forty-one per cent.

MEMPHIS AND KNOXVILLE RAILROAD.

Estimate of Cost of the First Division, extending from Memphis to Macon. Length 30 miles. Gauge 5 feet.

664	Stations,	Clearing and Grubbing,	$9 00	per sta.	$ 5,976 00		
461,150	Cub. yds	Earth Excavation, - -	30	" c. yd,	138,345 00		
150	Lin'l ft,	Girder Bridge, - - - -	12 00	" lin. ft.	1,800 00		
5,655	"	Piling and Tresling, - -	7 50	" " "	42,412 50		
41,520	Cub. ft,	Timber in Log Culverts,	03 1-2	" c. ft.	1,453 20		
36,950	"	Timber in Cattle Guards, Roads, &c., - - - - - -	03	" "	1,108 50		
9,860	Ft.B'd M.	Plank in Cattle Guards, - -	03	" ft. b.m.	295 80		
		Laying 30 miles of Track,	500 00	" mile.	15,000 00		
					$206,391 00		
79,200	Cross-ties, - - - - - - - -		40 cts. each,	$ 31,680 00			
	Engineering, Right of Way, Salaries, Office expenses, Stationery, Incidentals,			10,000 00	$ 41,680 00		
		Cost of Road Bed, - - - - - - - - - - - - - -				$248,071 00	
3,168	Tons of Rails (60 lbs. per yard), - - -		$90,00	per ton,	$285,120 00		
12,000	Joint Fastenings, - - - - - - - - -		1,00	each,	12,000 00		
165,000	Pounds Spikes, - - - - - - - -		5 cts	per pound,	8,250 00		
		Cost of Superstructure. - - . - - - - - - - -				$305,370 00	
		Total, - - - - -				$553,441 00	For Road Bed and Superstructure.

Cost per mile for Road Bed, - - - - - - - - - -	$ 8,269	
" " " " Superstructure, - - - - - -	10,179	
Total Cost for Road Bed and Superstructure, -	18,448	per mile,

MEMPHIS AND KNOXVILLE RAILROAD.

Estimate of the Cost of the First Division, extending from Memphis to Macon. Length 30 *miles. Gauge* 3 *feet.*

[illegible]	Stations,	Clearing and Grubbing,	$ 9 00	per sta.	$ 5,501 00			
244,200	Cub. yds	Earth Excavation, - -	30	" cub yd.	73,260 00			
150	Lin'l ft.,	Girder Bridge, - - - -	12 00	" lin. ft.	1,800 00			
5,655	"	Piling and Trestling, -	6 00	" "	33,930 00			
29,580	Cub. ft.,	Timber in Log Culverts,	03	" cub. ft.	887 40			
23,400	"	Timber in Cattle Guards and Road Crossings, -	03	" "	702 00			
6,620	Ft. B. M.	Plank in Cattle Guards and Road Crossings, -	03	" ft. b. m.	198 60			
		Laying 30 miles of Track,	375 00	" mile.	11,250 00			
					$127,329 00			
79,200	Cross-ties, - - - - - - -		30 cents each,	$ 23,760 00				
	Engineering, Right of Way, Salaries, Office Expenses, Stationery and Incidentals,			10,000 00	$ 33,760 00			
	Cost of Road-Bed, - - - - - - - - - - - - - -					$161,089 00		
1,584	Tons of Rails (30 lbs. per yard), - - -		$95 00	per ton,	$150,480 00			
10,500	Joint Fastenings, - - - - - - - - - -		80 cts.	each,	8,400 00			
105,600	Pounds Spikes, - - - - - - - - - - -		6 cts.	each,	6,336 00			
	Cost of Superstructure, - - - - - - - - - - -					$165,216 00		
					Total, - - - - -	$326,305 00	For Road-Bed and Superstructure.	

Cost per mile for Road-Bed, - - - - - - - - - -	$ 5,369 63	
" " Superstructure, - - - - - - -	$ 5,507 20	
Total Cost for Road-Bed and Superstructure, -	$10.876 83	per mile.

RECAPITULATION.

Distance.	Gauge.	Cost of preparing road-bed for rails.	Cost of superstructure.	Cost of road-bed and superstructure.
30 miles.	5 feet.	$248,071 00	305,370 00	553,441 00
30 miles.	3 feet.	161,089 00	165,216 00	326,305 00
Difference in favor of three feet gauge.		$86,982 00	140,154 00	227,136 00

COST PER MILE.

	Road-bed.	Superstruct'e.	Total.
Five feet - -	$8,269 00	10,179 00	18.448 00
Three feet - -	5,369 63	5,507 20	10.876 83
Difference of cost per mile in favor of 3 ft gau	$2,899 37	4,671 80	7.571 17

By adopting the narrow, or three feet gauge, the Company will
SAVE, On the cost of preparing road-bed, - - 35 per cent.
On the cost of superstructure, - - - - 46 per cent.
On road-bed and superstructure, - - - 41 per cent.

A fair estimate of the cost of building and equipping the first Division of the Memphis & Knoxville Railroad on five feet gauge would be $25,000 per mile, which would give for 30 miles,	$750,000
The amount of stock subscriptions which can be raised along the line will not exceed $8,000 per mile, which, for thirty miles, is - - - -	240,000
Leaving to be raised by bonds, or otherwise, -	$510,000
To which should be added say fifteen per cent. discount and commission, - - - -	76,500
Making the total to be raised by sale of bonds,	$586,500
Add interest at eight per cent. for say twenty years, - - - - - - - - - - -	938,400
To be paid in twenty years, - - - - - -	$1,524,900

A fair estimate for same Division on the three feet, or narrow-gauge, would be $13,000 per mile, or	$390,000
Stock subscriptions as above,	240,000
Leaving to be raised by bonds or otherwise,	$150,000
To which add fifteen per cent. discount, commissions, etc.,	22,500
Making the total to be raised by sale of bonds,	$172,500
To which add interest at eight per cent. for say twenty years,	276,000
To be paid in twenty years,	$448,500
To be paid by the broad, or five feet gauge,	$1,524,900
To be paid by the narrow, or three feet gauge,	448,500
Saved by using the narrow-gauge,	$1,076,400

in twenty years—$53,820 00 per annum.

Suppose the gross earnings of the road on either gauge to amount to $5000 per mile per annum, the saving on first cost would enable the narrow-gauge road to transact the same amount of business for five and one-half per cent. less than it could be transacted for by the broad-gauge. In other words, the Memphis & Knoxville railroad, built on the narrow-gauge, will be able to pay the same rate of interest on its bonds, and the same dividend on its capital stock, and then, by reason of its *reduced cost of construction alone*, carry freight and passengers for five and one-half per cent. less than it could possibly be done by the broad-gauge over the same route. In addition there will doubtless be a large saving in the expense of operating the narrow-gauge road, but of this I am not able to speak from experience.

Respectfully submitted,

THOS. H. MILLINGTON,
Chief Eng. Memphis & Knoxville Railroad.

COMPARATIVE COST

OF

BROAD AND NARROW-GAUGE RAILWAYS,

IN

MOUNTAINOUS DISTRICTS.

General William J. Palmer, President D. & R. G. R. Co.,

Dear Sir: I have the honor to submit the following

COMPARATIVE COST FOR A BROAD AND NARROW-GAUGUE FROM GOLDEN CITY TO BLACK HAWK, TWENTY MILES.

BROAD-GAUGE. Four feet, eight and a half inch.		NARROW-GAUGE. Three feet.		Differe'ce in favor of Nar'w Gauge.
	Per mile.		Per mile,	Per mile,
Golden City to mouth of North Fork of Clear Creek, thirteen miles, maxim'm grade 125 feet, maximum curve, 12°; from North Fork to Blackhawk 7 miles, max. grade 155 feet, max. curve 12°.		Golden City to Blackhawk, distance 20 miles, max. grade 175 feet, max. curvation 26°.		
Graduation, masonry, bridging and ballasting, - - - - - -	$46,425.00	Graduation, masonry, bridging and ballasting, - - - - - -	$7,200.00	$39,225.00
Superstructure, track, etc., - - - - - -	13,610.00	Superstructure, track, etc., - - - - - -	8,765.00	4,845.00
Depot buildings, repair shop, tanks, -	1,220.00	Depot buildings, repair shop, tanks, -	1,000.00	220.00
Engineering, superintendence and contingencies, - - - - -	4,500.00	Engineering, superintendence and contingencies, - - . - -	1,500.00	3,000.00
Total cost per mile.	$65,755.00	Total cost per mile,	$18,465.00	$47,290.00

Cost of broad-gauge per mile,	$65,755
" narrow " "	18,465
Difference in cost per mile,	$47,290
Cost of broad-gauge for twenty miles,	$1,315,100
" narrow " "	369,300
Difference in cost for twenty miles,	$945,800

The Denver & Rio Grande Railway use

For width of road-bed in cuts,	12 feet.
" " " " banks,	10 feet.
Sharpest curve,	6 degrees.
Maximum grade (for nearly 30 miles,)	75 feet per mile.
Length of ties,	6 1-2 feet.
Weight of iron,	30 lbs. per yard.
Slope of earth cuttings,	1 to 1
" banks,	1 1-2 to 1
" solid rock cuttings,	1-4 to 1

These estimates are made from careful surveys, the most of the lines being actual locations; the curved lines having been run at all the most difficult points. Having no reliable data from which to estimate the cost of rolling stock, etc., particularly the motive power for operating on grades of 150 to 175 feet per mile with the maximum curvature of twenty-six degrees, I have not given an estimate for equipment.

Estimated weight for iron rails as follows:

For broad-gauge,	65 lbs. per yard.
For narrow-gauge,	40 " "

There would appear to be a discrepancy in the engineering and contingency estimate (by comparison), accounted for by the difference in the length of time to construct; there being unavoidably three tunnels on the broad-gauge (if only twelve degree curves are used), which would keep up an organization for engineering and superintendence two years instead of six or eight months, in which the narrow-gauge can be completed. The extension of line from Blackhawk to Central City can be made at the average cost for narrow-gauge given; distance about seven miles; but I think it hardly possible to build for broad-gauge with twelve degree curves.

Very respectfully,

(Signed) J. P. MERSEREAU.

OMAHA, NEBRASKA, November 9th, 1871.

MY DEAR SIR: I inclose you the Directory with blanks filled up as requested.

An approximate location has been made during the last two months from Pine Bluff to Nevada, Cal., and the line has been definitely located from Golden City to the forks of Clear Creek, thirteen and one-half miles. Of this distance five miles have been graded since the 1st of September, on which occurs the heaviest work through the canyon. On this thirteen and one-half miles the creek falls 1,700 feet. The cost of grading a road-bed through the canyon for a four feet eight and one-half inch track was estimated to be $90,000 *per mile*. The *actual cost* of grading a road-bed for a *three feet track* has not exceeded $20,000 *per mile.*

It is expected that the road will be completed from Pine Bluffs to Nevada by the 1st of September next, and a branch twenty-two miles long from the forks of the creek to Georgetown, by January 1st, 1873. A third rail will be laid on the ties between Denver and Golden City, fifteen miles, making the entire length of the Colorado Central Railroad and branches—192 miles of narrow-gauge and fifteen miles of four feet eight and one-half inch gauge.

Respectfully yours,

(Signed) T. E. SICKELS.

TO DR. R. H. LAMBORN, VICE-PRESIDENT DENVER AND RIO GRANDE RAILWAY:

Considering the saving announced by Mr. T. E. Sickels as somewhat extraordinary, I wrote to that gentleman to ask him some explanations, and obtained the following reply:

OMAHA, NEBRASKA, November 28th, 1871.

C. J. QUETIL, ESQ.:

DEAR SIR—I have received your letter of 20th inst. The large difference in the cost of grading for a broad-gauge and for a narrow-gauge road through Clear Creek Canyon, Colorado, results from the fact that the locations of the two lines occupy different ground. On the broad-gauge location the minimum radius of curvature adopted was 955 feet, and on the narrow-gauge it is 220 feet. The canyon is about 3,000 feet deep, and has precipitous sides. Its course is so tortuous that the broad-gauge location would have required in construction numerous tunnels and bridges across the stream, with high embankments and deep, open rock cuttings.

The adoption of the narrow-gauge admitted of an alignment conforming approximately to the windings of the canyon, and enabled us to obtain a graded road-bed for less than one-quarter of the estimated cost of a broad-gauge road-bed, with the additional advantage that increase of distance secured more favorable grades.

Yours truly,

T. E. SICKELS.

REPORT

OF THE ENGINEERS OF THE WESTERN MARYLAND RAILROAD. ON THE EXPEDIENCY OF CHANGING PRESENT LINE OF FOUR FEET EIGHT AND ONE-HALF INCH GAUGE TO DOUBLE LINE OF THREE FEET OR "NARROW-GAUGE."

To the Hon. James L. McLane, President Western Maryland Railroad, Baltimore:

SIR :—We beg to submit to you the following report of our investigations of a subject that has attracted the attention of railway managers throughout the world, in which the interests of your city are deeply involved, and which is of vital importauce to your own road.

The testimony which has been given by trustworthy men, of large experience in railway working, deserves serious consideration, and as their evidence is in favor of a departure from a beaten path, and in advocacy of a change of the existing gauge of our iron roads, acute minds will examine the whole subject before entering upon the construction of that class of railways which in too many cases has proved unproductive. We know that you can investigate this question without prejudice, for the great interests of your State and city; and as your road, now about to be completed, is destined ere long to be a part of a great line from the coal fields of Allegheny county to the harbor of Baltimore, that you will in its behalf, sustain whatever you find to be correct in principle, and that offers in the future additional productiveness in return for the aid so largely received by your road from the citizens of Baltimore. We have entered primarily upon the question of gauge as bearing on the prospects of future roads generally, relying on the wisdom and sagacity of all those interested to apply the results to the works which are the objects of their solicitude. We will afterwards examine the effect a narrowing of the gauge would be likely to have on the present and future prospects of the Western Maryland Railway.

GAUGE FOR TRUNK LINES.

Can long Trunk Lines be made of the three feet gauge?—"Good and sufficient reasons" have been given why the three feet gauge should be adopted for some of our future railways; but it has been asked whether this change will not militate against capacity for *speed*, and for the *transportation of large tonnage*, which will be the characteristics of long lines yet to be constructed? This inquiry has been made sooner than was expected, but is eminently proper and opportune, in order that future large expenditures may be wisely made, and that the experience of the past may teach us lessons profitable in the future. The minds of railway men have of late been much exercised on this subject, and few among the vast number of those interested have attempted to combat the new principle, readily admitting that for short lines and branches a gauge less than the Stevenson standard is admissible.

Will Leading Lines adopt the three feet Gauge?—But the question put, points evidently to greater things, and plainly asks if long and leading lines of railway cannot be brought within the influence of those advantages, available on the shorter roads. Professional opinions and practical facts have been laid before the public by our daily press and railway journals, which have aroused reflecting minds to the importance of the subject; but the views and information given have of necessity been so scattered as to leave many without that conviction to which a clearer conception would have led them. We will endeavor now to reply to the querist, and treat the whole subject succinctly, plainly and practically, working out *results*, that our communities may have the entire question condensed before them, and be able to decide for themselves how far they are justified in encouraging a movement which, if wrong would be ruinous, and if *right*, it would be their plain duty to aid, encourage and adopt. For this purpose we propose to show the *cost* and *character* of the two gauges, assuming each to be constructed as a first-class road, built under like circumstances, and through a similar country. In contrast with our standard gauge of four feet eight and one-half inches, we have taken the three feet gauge, as affording the best proportion between the carrier and the thing carried.

Heads of Report.—The subject will be treated of under the following heads: (1.) The cost of construction, embracing land, works, permanent way, and engineering. (2.) Grades and curvature, with their relative effects on both gauges. (3.) Outfit,—its quantity, weight, capacity and cost. (4.) Speed and stability. (5.) Operating expenses and maintenance of way. (6.) Revenues and dividends. (7.) Branch lines of three feet, connecting with roads of the standard gauge; how they can be made available. (8.) Recapitulation and condensation of results, and general remarks.

I.—THE COST OF CONSTRUCTION.

Under this head we have assumed that both roads are to be for double track, built through a country of bold topographical features, where the engineer is put to the test to find a line that will afford him maximum gradients of forty feet per mile, with a given minimum of radius for curvature, and where he may be compelled to adopt in an extreme case a grade of eighty feet per mile.

COST OF A MILE OF DOUBLE TRACK ROAD.

4 ft. 8 1-2 in. Gauge.		3 Feet Gauge.	
Land and fencing, - -	$2,000	Land and fencing, - -	$1,700
Clearing, - - - -	600	Clearing, - - - -	500
Graduation, - - -	28,700	Graduation, - - -	19,000
Masonry, - - - -	6,000	Masonry, - - - -	4,000
Stations, - - - -	2,000	Stations, - - - -	2,000
Contingencies, - - -	4,100	Contingencies, - - -	2,400
Engineering, - - -	3,200	Engineering, - - -	2,400
Double track, 65 lb. rail, -	22,000	Double track, 45 lb. rail, -	15,700
Switches, - - - -	600	Switches, - - - -	400
Total, - - - .	$69.200	Total, - - - -	$48,200
Difference, $21,000 per mile.			

The above estimate of the three feet gauge road largely exceeds the proportion given by other engineers, some of whom have derived their figures from actual surveys, plans and profiles. It is therefore submitted as a safe and reliable comparison.

The Financial Result Stated.—Such being the case, we find that by constructing a three feet gauge road in place of the standard, there will be a saving on one hundred miles of double track road of $2,100,000. Now let us suppose that $6,920,000 capital has been raised to build this one hundred miles of road of the standard gauge. There would, in such case, be left in the Treasurer's hands after the completion of the three feet gauge, the above amount of

$2,100,000. Compound this sum at seven per cent., and in ten and one-half years the one hundred miles of new three feet road would stand debtor on the company's books for *only* $620,000, or at a cost to its proprietors of $6,200 per mile.

Here is one illustration of the advantage to be gained by building a three feet gauge in place of the standard. The illustration will be appreciated when it is remembered *that the result is gained after adding about eighteen per cent. to the cost of the narrow road,* as given by good authorities. But let us assume now that in ten and a half years, but one-half instead of near six-sevenths of the capital will be repaid. The promise is still so rich, even with all the margin given for safety, that we cannot but be convinced that as to first cost, at all events, the three feet gauge is preferable.

II.—GRADES AND CURVATURES.

Under this head the question of

GRADES,

is first considered. It has been stated by enthusiastic writers on the subject, that a narrow-gauge engine has more power, in proportion to its weight, than that of the standard road, and can therefore, work against steeper gradients, with the same gross load; but this is not the case.

POWER OF LOCOMOTIVE ON GRADIENT.

The actual power of the Locomotive is not in any wise affected by the width of gauge. The facts are these: A three feet engine that can take the same *gross weight* of train up a given grade will have more *paying load* in that train; and the train that contains the *same weight of paying load* will have less weight of cars—and, therefore, be a lighter train in its gross weight, though having the same paying load; ; hence the lighter train, though having the same paying load, can be taken by the three feet engine over steeper grades. and the *same gross weight of train will contain a greater productive load.* To exemplify this, engines of both gauges on a level road will transport a train of say of one thousand four hundred and sixty tons, of two thousand two hunded and forty pounds, gross weight as follows:

On a Level—gross weight of train, one thousand four hundred and sixty tons. The three feet engine, with three hundred and ninety-nine tons of cars, will haul, of coal, one thousand and sixty-four tons. The four feet eight and a half inch engine, with five hundred and sixty-six tons of cars, will haul, of coal, nine hundred tons.

On a maximum grade of twenty-six four-tenth feet,—gross weight being five hundred and eighty-seven tons,—the three feet engine, with one hundred and sixty tons of cars, will haul, of coal, four hundred and twenty-seven tons; the four feet eight and a half inch engine with two hundred and twenty-six tons of cars, will haul, of coal, three hundred and sixty-one tons.

On a maximum grade of forty feet,—gross weight being four hundred and forty-four tons,—the three feet engine, with one hundred and twenty-one tons of cars, will haul of coal, three hundred and twenty-three tons. The four feet eight and a half inch engine with one hundred and seventy-one tons of cars, will haul of coal, two hundred and seventy-three tons. These trains, it will be seen *correspond in gross weight*, the three feet gauge, by its *less* weight of cars, transporting about seventeen per cent. *more productive load* than the *standard gauge.*

On a gradient of eighty feet per mile—gross weight two hundred and fifty-two tons. The three feet engine, with seventy tons of cars, will haul, of coal, one hundred and eighty-two tons. The four feet eight and a half inch engine, with ninety-seven tons of cars, will haul, of coal, one hundred and fifty-five tons.

YEARLY TONNAGE ON DIFFERENT GRADES.

To elucidate the monetary values of the two gauges, when taken in connection with grades, we will assume a given number of engines of this class, say twenty, to be employed in the transportation of coal, and ascertain what would be the tonnage of each road, delivered, annually at market, making a trip in two days, with their respective gross earnings, as follows:

4 feet 8 1-2 in. gauge. Tons.		Three feet gauge. Tons.
2,808,000	On a level road, - - - - - - - - -	3,319,680
1,126,320	Maximum grade of 26 4-10 against trade,	1,332,240
843,640	Maximum grade of 40 feet against trade,	1,007,760

Putting these respective annual tonnages at one and a half cents per ton per mile, for transportation charges, or one dollar and fifty cents per ton on one hundred miles, we obtain the annual money receipts, from each road on the different grades specified, viz :

MONIED VALUE OF COAL TONNAGE—COMPARATIVE ANNUAL RECEIPTS.

From the three feet gauge on a level road,	$4,979,520
" " four feet eight and a half inch on a level road,	4,212,000
Annual excess of receipts of the three feet road,	$ 767,520
From three feet gauge on maximum grades of twenty-six four-tenths feet,	$1,998,360
From four feet eight and a half inch gauge on maximum grades of twenty-six and four-tenth feet,	1,689.480
Annual excess of receipts of the three feet road,	$ 308,880
From the three feet gauge on maximum grades of forty feet,	$1,511,640
From the four feet eight and a half inch gauge on maximum grades of forty feet,	1,272,960
Annual excess of receipts of the three feet road,	$ 238,680

LESSONS LEARNED.

From the foregoing we learn : (1). That an engine of the three feet gauge can take a *greater number of tons of freight* in its cars, against the same grade ; and (2). That it will haul the *same number* of tons of load in its cars up steeper grades, than the engines of the four feet eight and a half inch, gauge with *its* loaded cars, can at all accomplish. We have shown before, that the load of *freight* on the four feet eight and a half inch, against a twenty-six and four-tenth grade is three hundred and sixty-one tons, and that this *freight* load can be increased on the three feet gauge to four hundred and twenty-seven tons, against a like grade ; so, also, can it be stated that the freight load of three hundred and sixty-one tons, not being increased on the three feet road, it could be taken by the narrow-gauge engine over thirty-three feet grades, instead of twenty-six four-tenths feet, a gain in gradient obtained of twenty-five per cent., by the adoption of the three feet gauge. Again : The freight load of the standard gauge is given at two hundred and seventy-three tons on a forty feet grade, and the corresponding freight load on the three feet, is three hundred and twenty-three tons ; but leave the same two hundred and seventy-three tons to the three feet engine with its own furniture, and it will surmount a gradient with it of fifty feet, instead of forty, which also shows an increase of gradient available, if required, of twenty-five per cent. in favor of the smaller road. So, *likewise*, the freight load of the four feet eight and a half inch, engine on a gradient of eighty feet, being one hundred and fifty-five tons, that of a three feet would be one hundred and eighty-two tons; but giving the three feet engine, the load only of its rival, or one hundred and fifty-five tons, it will transport it over grades of ninety-five feet, or about twenty per cent. greater.

It seems, then, clear that while the *steam power* of the three feet gauge engine is *no greater* than that of the other, the *paying power* of the narrower road exceeds that of the standard by two hundred and thirty-eight thousand six hundred and eighty dollars, to seven hundred and sixty-seven thousand five hundred and twenty dollars per annum on one hundred miles, according to the character of the gradients worked on ; and that, keeping the same paying loads as the wider gauge, the smaller road can with equal income overcome gradients from twenty to twenty-five per cent. greater.

WEIGHT OF LOCOMOTIVE.

In order to elucidate the more clearly the foregoing part of the subject, it was deemed best to assume tne very largest class of locomotive, possible to put on the three feet gauge, with cylinders of fifteen by eighteen, thirty-six inch drivers and thirty tons weight and with a tractive power on a level equal to one thousand four hundred and sixty tons, so as to compare it directly with an engine of equal power on the standard road. In the practical working of a three feet line, we would *recommend a locomotive of a maximum weight of twenty-three tons*, as the most advantageous and economical for a heavy tonnage. The load on the *level* with this class of engine, would be reduced to one thousand one hundred and twenty tons. It has been shown that the three feet engine of equal power with those of the four feet eight and a half inch road, will transport more actual freight load in its cars during the year —amounting to five hundred and eleven thousand six hundred and eighty tons over a *level* road, and to one hundred and fifty-nine thousand one hundred and twenty tons against maximum grades of forty feet per mile. Now, if the weight of the locomotive on the narrower road be in practice, brought to twenty-three tons, the daily work of each engine on forty feet grades, will be likewise decreased from three hundred and twenty-three tons of *freight* to two hundred and fifty-four tons ; and, consequently, to transport a like yearly freight tonnage, there will be required an additional number of locomotives. The former number of twenty will, therefore, be increased on the three feet road in this calculation to twenty-six. It is true these twenty-six smaller engines *will transport in the year six thousand tons more* than is due to the former twenty of greater power; but this six thousand tons is the nearest we can get in arranging for the additional engines required, and we will throw them into the scales on the side of the four feet eight and a half inches, and take credit here for them, as indicative only of the moderation and impartiality with which we desire to treat the whole question.

RESULTS STATED.

We have now arrived at the result that twenty engines of the standard gauge will transport in the year the same gross weight as twenty-six engines of the three feet gauge; the smaller engines, however, taking to market 165,300 tons more of coal than the twenty, over grades of forty feet, the steam power exercised being the same. We also deduce from the previous figures, that while the locomotive of the wider road can take the cars which it brought down loaded over a level road, back to the mines against maximum grades of twenty-six feet per mile for *short* distonces, the smaller locomotives will return their cars under like circumstances for reloading, against *long* gradients of forty-eight feet per mile; and, further, that they will haul all the cars empty, which they transported with full loads to market against 26 4-10 feet back to the coal region, against gradients of 135 feet per mile, while the wider engine with its empty cars will be able to overcome grades of only ninety feet.

CURVATURE.

The American "Bogie" truck has rendered admissible on our railways a curvature that law forbids in other lands; but that we have gone in this direction beyond the limits prescribed by economy or prudence is undeniable.

THE LIMITS OF CURVATURE.

Our railway machinists are practically acquainted with the abrasion that is caused by flange friction on curves of short radii, and how rails as well as tires suffer. If we reflect that some of our chief roads of the standard gauge have curves of 600 feet, and even as low as 400 feet radius, and that experience shows that friction is greatly reduced on the narrower gauge road, as it evidently must be,—we may certainly permit, in exceptional cases, radii of say 600 feet on the three feet gauge, without incurring the injury to the rail and rolling stock now inflicted on our standard gauge roads. It would be well and wise for our several *States to enact laws establishing the gauge*, and forbidding the narrower road to use curves of less than ten degrees, or 573 feet radius. We have adopted as a minimum for our future guidance a radius of 637 feet or nine degrees; and in this we think there will be an element so valuable, that combined with the power we have shown of increasing gradients without diminishing the paying properties of the road, it will enable the close-locating engineer, by manipulating both judiciously, to fit his line to the contours of difficult, mountainous regions, and avoid or greatly reduce severe cuttings, lofty viaducts, and expensive tunnels. We are of the opinion that the character of the three feet gauge will enable engineers to reach higher and more favorable ground in their locations, to obviate much of the necessity of making their roads tortuous, and to obtain long, straight lines that would not be within the reach of the four feet eight and one-half inch road.

III.—OUTFIT.

We will first state the

AMOUNT AND COST OF ROLLING STOCK

requisite on the four feet eight and one-half inch road for the assumed coal traffic transported against maximum grades of forty feet per mile, by twenty locomotives, with trains of a gross weight of 444 tons, yielding a yearly tonnage of 848,640 tons. We will add 125,200 tons of general goods per annum taken by one daily train each way, carrying each 200 tons of productive freight; and 166,500 through passengers conveyed in two trains daily each way, with 133 passengers in each train.

ASSUMED BUSINESS OF 4 FEET 8 1-2 INCH ROAD.

This traffic on the four feet eight and one-half inch road will require without any allowance for extra engines or cars, for the

COAL TRADE OF 848,640 TONS.

20 locomotives at - - - - - -	$12,500	$250,000
1,160 coal cars at - - - - - - -	275	319,000
Total, - - - - - - - - - - -		$569,000

GENERAL FREIGHT OF 125,200 TONS.

25 box cars at	$ 685	$17,125
25 flat cars at	550	13,750
2 freight engines at	12,000	24,000
Total,		$54,875

PASSENGERS—166,500.

20 passenger cars at	$ 5,000	$100.000
4 express and mail at	3,000	12.000
4 baggage at	3,000	12,000
4 passenger engines at	12,000	48,000
Total,		$172,000
Total cost of outfit for 4 feet 8 1-2 inch road,		$795,875

PROPORTIONATE ASSUMED BUSINESS FOR A THREE FEET ROAD.

With the same business in general freight and passengers, because each road would do the whole trade available in each of these branches, and with the same *gross weight of loaded trains*, in the coal traffic (only the little engines having 159,120 tons *less weight* of cars all through the year, are compelled to take just 159,120 tons *more of coal* to make up the total *gross weight* of their trains), the three feet gauge will require for the

COAL TRADE OF 1,007,760 TONS.

26 locomotives at	$9,000	$234,000
1,766 coal cars at	185	326,710
Total,		$560,710

GENERAL FREIGHT OF 125,200 TONS.

45 box cars at	$ 450	$20,250
45 flat cars at	340	15.300
2 freight engines at	8,500	17.000
Total,		$52,550

PASSENGERS—166,500.

24 passenger cars at - - - - - - -	$2,000	$48,000
4 mail and express at - - - - - - -	1,500	6,000
4 baggage cars at - - - - - - -	1.500	6,000
4 passenger engines at - - - - - -	7,500	30,000
Total, - - - - - - - - - - -		$90,000
Total cost of outfit for 3 feet road, - - - - -		$703,360

Being a saving in expense of outfit of $92,615 by the adoption of the three feet gauge, which transports the largest *paying* tonnage. The capacity, quantity and cost of the outfit having been given, there only remains on this third head to speak of the

COMPARATIVE WEIGHTS OF ROLLING STOCK.

We are cognizant of the fact that in one coal district, iron coa cars are used with a capacity double the dead weight; but this is an exception · our deductions are based on the capacity of cars in general use.

WEIGHT OF ROLLING STOCK.

	For 4 ft. 8 1-2 in. gauge. lbs.	For 3 ft. gauge. lbs.
Coal engines, - - - - - - - - -	78,000	51,500
Freight engines, - - - - - - -	70,000	35,000
Passenger engines, - - - - - - -	67,200	30,000
Coal cars, - - - - - - - -	6,600	3,000
Freight cars, - - - - - - - - -	20,000	7,000

IV.—SPEED AND STABILITY.

These are considered separately.

SPEED.

Some writers have asserted that the decrease of gauge of the railway will be at the sacrifice of speed. *Theoretically,* under certain conditions, this would seem to be correct, but we prefer to deal with the question *practically.*

SPEED ATTAINED AND ITS COST.

Fifty and sixty miles an hour are given as rates beyond the capabilities of a three feet road. This may be so, but a speed of sixty miles for regular passenger trains has never been undertaken yet, except by one road, of seven feet gauge, in England. This rapid speed pleased travelers amazingly, and they willingly paid the extra charge for the luxury of being shot through the country with a rapidity so great as to render even the way-stations of the line invisible to the occupants of the train; but the *railway company* paid too dearly for the enjoyment of its patrons. It was soon found to be another great error, for the "wear and tear" on road and rolling stock was beyond the endurance of finance, and this high speed was consequently abandoned. There are but few trains now in England that make regular time at fifty miles an hour; the express passenger traffic is done at from thirty-five to forty miles, and the general traffic at about twenty-two. In our own extended country the "lightning trains" on some of our roads have scarcely reached thirty-four miles an hour, average speed; and even the approach to this rate has been discontinued, so that our fastest do not now average more than thirty miles, whilst our general passenger business is done at a speed not exceeding twenty miles an hour. Coal and iron trains have been wisely brought down as low as from eight to twelve miles, and our freight trains usually run from sixteen to eighteen miles per hour. Where, then, is the *'great sacrifice in speed*" which the three feet roads will compel us to make? Let these roads be constructed with no curves of less radius than 600 feet, and the speeds now in use on the standard roads will be fully maintained. On comparatively straight roads from thirty-five to forty miles per hour can be regularly run.

With reference to the

VELOCITY OF THE WHEELS

of the two classes of engines, we would remark that an engine of the standard gauge, with sixty-inch drivers, will revolve them two hundred and twenty-four times a minute at a speed of forty miles an hour; while the forty-inch drivers of the smaller engine will make three hundred and thirty-six revolutions, or one hundred and forty-five less than the truck wheels of our passenger engines on the four feet eight and one-half inch road at the same speed. We are of the opinion, therefore, that the three feet gauge for all practical purposes is equal to any required speed.

STABILITY.

Some inquiries have been made as to the comparative stability of the coaches of the three feet gauge. The sharp curvature, which

has been so unwisely advocated and lauded, as one of its good features, with the decreased wheel base, it was thought would produce a want in this particular.

CONSTRUCTION OF PASSENGER COACHES.

That the passenger coaches of the one road are equally as safe as those of the other in this respect, can be shown. The construction of the coaches of the three feet gauge brings the centre of gravity much lower than in the cars of the standard road, and the projections of the sides of the body over the rails is less by two to four inches. Again, that portion of the body which is vertically over and between the rails is twice as heavy as either part of the same that projects therefrom on either side; hence, before the smaller coach could be overthrown, a force greater than three-fourths the weight of the main part of its body and one of its sides would have to be exerted. It will be found also that the three feet coach is really more steady when traversing such sharp curvature as exists on some of our standard roads, because the decrease of the wheel base secures a freedom to the trucks on curvature which the others cannot possess; and *this* is an element of safety in itself.

From a circular of H. Schuyler, Esq., Chief Engineer of the Denver & Rio Grande R., (a three feet line of eight hundred and fifty miles, now in progress of construction, with eighty miles completed,) I find the dimensions of the coaches, built by Jackson & Sharp, of Wilmington, Del., for that road, are

Length over platform, - - - - - - - - -	40 feet.
Outside width, - - - - - - - - - - -	7 "
Height in centre, - - - - - - - - - -	10 "
Height of floor above the rails, - - - - - -	27 inches.

Seats for thirty-five passengers; weight of empty car on scales, 15,000 pounds. We have examined these coaches, and are convinced they are as safe a conveyance for passengers as can be found anywhere in the United States, and infinitely more safe than any coach with four or six wheels set on a rigid frame; and there is nothing to justify the belief that passengers cannot be carried on *long routes* with all the comfort they can desire, and at less expense.

The three feet roads, it is conceived, should use invariably that best of American railway plans, the equalizing truck under their passenger coaches, gaining thereby safety, steadiness of motion and facility for working on curves; and we think it is equally applicable to freight or coal cars. We have in the United States the best plan of coaches in the world for the conveyance of our people, and can make it better than it even was before; for the American car, modify it as you will in its interior, is the safest, most steady, and most convenient to be found anywhere. It should not be given up.

V.—OPERATING EXPENSES.

We have little more than theory to guide our views as to the actual working expenses of the three feet road, but we deem it sufficient to state a few facts that have led us to the conclusion that the *general operating expenses must be comparatively small.*

MONSTER LOCOMOTIVES.

First and foremost, and of paramount importance to our new railway interests, there will be no monster of locomotive weight to crush out the life of everything it rolls over, and if the weight carried by every "plant" wheel be lessened one-half, the wear and tear will be reduced beyond this proportion, because destruction will cease, and reasonable wear only be in existence. On the three feet road we shall have 2,000 lbs. less on each wheel of passenger coaches, and from 10,000 to 17,000 lbs. less on each pair of drivers of the locomotive transporting them at high speed. Iron rails will no longer be destroyed before they are one-third worn out, and this will be reciprocated by the rolling-stock, so that the *two largest items in railway operating expenses will be directly brought to a reasonable amount, and within the limit of actual wear.*

Some of our standard roads find their yearly

OPERATING EXPENSES

running up to seventy and seventy-five per cent. of the gross earnings, while many roads in England are working at fifty to fifty-five per cent., and one of the standard gauge in operation as low as forty-eight per cent. It has been shown in a previous treatise that in view of the increased receipts of the three feet roads, forty per cent. would pay the operating expenses, yielding sixty per cent. for dividends. We deem it, therefore, a safe estimate to state that the three feet roads can be generally worked as cheaply as the most economically managed road we know of the four feet eight and one-half inch gauge, or at forty-eight per cent.

But while this percentage seems low, it must be remembered it is produced from a *greater gross income*, which in its turn will swell the net revenue, thus conferring benefit in a double way.

DECREASE OF EXPENSES.

Besides the large saving made by the decrease of moving weights on the rails and plant, the same cause will work with similar effect on everything in each department subject to wear and tear—less men will keep the roads in order; ties will last longer, and when renewed will cost three per cent. less; smaller quantities of ballast will be annually needed; timber structures will not be so severely tried, and if protected from the weather will require but trifling repairs for fifty years; renewals of rails that will last about as many years as they now in some cases last only months, will be at length made at a cost of $1,500 to $2,200 less per mile; and so we could go on enumerating many things by which operating expenses must be of necessity reduced. But before passing from this part of our subject, we would mention that the increased earnings of the smaller road, even were the working expenses the same in dollars and cents, would show a vast decrease in the percentage of gross earnings due to such expenses.

We have shown that the three feet gauge would, over forty feet grades, in a business of one million of tons in the year, swell the gross receipts by the sum of $238,680. Here, then, is $2,386 per mile, *enough to put down a new double track every seven years, or to add each year over one-third increase to all the rolling stock,* estimated for the one hundred miles of road, in its coal, freight and passenger business—leaving $1,272,960 a year from its coal business alone to meet the cost of operating and pay dividends to stockholders; the receipts from general freight and passenger traffic being additional income, not included in the calculations, but reserved for their proper place under the head of

VI.—REVENUE AND DIVIDENDS.

The resultant of all the preceding subdivisions is

REVENUE,

which is derived from a traffic transported over maximum gradients of forty feet per mile; the cost of the outfit for which has been already given under its proper head.

Revenue from Standard Road

Coal, 848,640 tons, at $1.50,	$1,272,960
General freight, 125,200 tons, at $3,	375,600
Passengers, 166,500, at $3,	499,500
Gross revenue of standard road,	$2,148,060
Operating expenses, 70 per cent.,	1,503,642
Net revenue,	$644,418

Revenue from Three Feet Gauge—

Coal, 1, 7,760 tons, at $1,50,	$1,511,640
General freight, 125,200 tons, at $2.50,	313,000
Passengers, 166,500, at $2.50,	416,250
Gross revenue of three feet road,	$2,240,890
Operating expenses, 48 per cent,	1,075,627
Net revenue,	$1,165,263

DIVIDENDS.

Taking the cost of one hundred miles of road (under head I.) at $6,920,000, and the outfit (under III.) at $795,875, we have a total capital for the standard road of $7,715,875, on which the net revenue of $644,418 will yield an annual dividend of seven per cent., with one and one-fourth per cent. for retirement of the bonded debt. The three feet road, with no bonded debt, but a stock capital of $5,523,260 for construction and outfit,—by its net revenue of $1,165,263 will pay its shareholders twenty-one per cent. dividend, and have a surplus in the treasury of $5,378.

DECREASE IN FREIGHT RATES.

You will notice that the freight tonnage on the three feet gauge has been put in the calculation of revenue at $2,50 per ton, in place of $3 on the standard road. The justification of this will be found in the fact that with 200 tons of freight transported on each train on the smaller gauge, the gross weight of the train would be 372 tons; while the same freight load on the wider road would bring the gross weight of train to 495 tons, the difference being 123 tons. This doubled for the up and down freight trains, would give a daily saving of 246 tons, and in the year 76,998 tons, for which motive power and steam would not have to be provided. Putting this tonnage at even one cent per ton per mile, or $1 on the 100 miles,—it would be equivalent to a diminution in working cost of

$76,998. This amount, added to $313,000, the gross revenue derived from the freight charge of $2.50 on the three feet road,—would be increased to $389,998, *or more than the gross revenue from the standard road from freight at* $3 *per ton.* It is clear, then, that charges in general freight can be reduced to the public, while producing greater profit to the railway company.

PASSENGER FARES BROUGHT DOWN.

There is good reason, also, for making the passenger fare on the one hundred miles of the three feet road $2.50, instead of $3; for while twenty cars are taken as the conveyance on the four feet eight and one-half inch track of 530 passengers per diem, and twenty-four cars will be used on the smaller line to transport a like number,—the twenty wide-gauge cars will weigh 295 tons, but the twenty-four three feet gauge coaches will weigh only 161 tons—each set of cars carrying thirty-six tons of passenger load. The smaller road will, including the engine weights, have 154 tons less to provide steam for, each day; and this in the year will amount to 48,200 tons, which at one and three-fourths cents per ton per mile, would be $84,353 to the credit of the working expense on passenger trains of the smaller gauge road. Add this to the receipts from passenger fares at $2.50, and it will fully equal the receipts from the same source on the standard line at $3.

This decrease in operating expenses in the transportation merely of the freight and passenger traffic, amounts to seven and one-half per cent. of the gross revenue of the wide road; and when we can arrive at the reduced wear on rolling stock and permanent way, caused by the same thing, with the other advantages before alluded to, it will, we think, be apparent that our forty-eight per cent. of gross revenue for working expenses on the three feet road is really a large allowance.

VII.—BRANCH LINES OF THREE FEET GAUGE

connecting with the standard roads, form this subdivision of our subject. The argument often heard, that the existing roads are of the standard four feet eight and one-half inch gauge; that they are the great trunk lines of the country; that their branches must be of a corresponding gauge, and that it is now too late to advocate any change, is certainly a very summary way of settling the whole question. We beg leave to differ from such views.

TRUNK LINES OF THREE FEET GAUGE.

The present trunk lines will remain so, and their glory none will rob them of. *They have paid for it and are entitled to it;* but who will assert that there shall be no other main routes to be opened in this great land, which stretches nearly from the equator to the arctic circle, and lies between the two great oceans of the world? When the thinking public can realize that the smaller lines can be carried on more favorably through this wide continent—when they see practically demonstrated the truth of the positions taken in these pages,—then there will be no more question about building three feet branch lines, for they will radiate in tenfold greater number from their own trunks, sending back to the parent stems an influence a hundred-fold more fructifying than the standard gauges can now boast of.

STANDARD ROADS CAN HAVE THREE FEET BRANCHES.

The present main roads, while conservative of their own plans, will find that they need not be without a share of the advantage offered by the smaller gauge. The whole question of branch roads can be narrowed down to a small compass, and controlled by a few common sense rules, viz:

(1.) *Short Branch.*—If a branch line be *short*, and means are available to make it of the standard gauge, it should be so built; but if the capital be inadequate, especially if the traffic be light, construct a three feet road, and tranship at the junction with the main road. This will at least change locomotion on the short route from slow horse-work to prompt and rapid communication with the main channel.

(2.) *Branch of Fifty Miles.*—If a branch has to be longer, stretching forty or fifty miles, through a district where the wide road could not be constructed for less than $20,000 or $30,000 per mile, and funds are insufficient,—build the three feet road; save from $8,000 to $12,000 per mile, and a *sum equal to the interest on such saving will pay annually for the transhipment of goods requiring it.* The cost of transhipment is given by writers at from ten to thirty-five cents per ton. The latter price will store in warehouse after handling, and reship therefrom. There are two methods by which transhipment can most easily be effected—without any such cost as the latter figure being incurred. One is to lift by suitable cranes the bodies of the loaded freight cars of the smaller roads upon the flat cars of the main line. This plan is objectionable because it adds to the disadvantage of dead weight already complained of on the wide road ; yet, if the distance to be thus transported be not great,—once the arrangements were made, the transhipment would not cost the smaller road over ten cents per ton, and the main road would, perhaps, be remunerated enough to make it an object to it. Another plan, patented, we believe, by Maj. A. F. Sears, (late) Engineer of the Sodus Bay R., is to shift the bodies of the cars of the three feet road from their trucks to special trucks of the four feet eight and one-half inch—the whole operation being performed automatically by running the cars back and forward on a peculiarly arranged system of trucks. The expense of transhipment by such a method would probably not exceed six cents per ton.

(3.) *Branch of Eighty Miles.*—When a branch will reach sixty or eighty miles, and cannot be constructed on the more costly plan, and especially when the main line with which it is intended to connect, is of equal or not more than twice its length,—it will pay to *lay down a third rail* on the cross-ties of the wide road, at the expense of one or both of the companies; and thus the locomotives of the standard gauge can make up by means of newly invented coupling their trains from cars of both gauges, as convenience or necessity may dictate.

THIRD RAIL PAID FOR.

We will show how this third rail can be paid for by building a three feet branch in place of the wider road :

Eighty miles of four feet eight and one-half inch line, at $25,000 per mile, would be - - - - - -	$2,000,000
Eighty miles of three feet line, at $15,000 per mile, would be - - - - - - - - - - - - -	1,200,000
Thus saving on the eighty miles - - - - -	$800,000
Eighty miles of third rail, of forty-five pound iron, at $2,856, will cost - - - - - - - - -	228.480
Showing still as a measure of saving - - - -	571,520

It will be observed that the main road might be even 160 miles in length, and yet there would be a saving in the adoption of the three feet gauge of $343.000. As every new branch line that thus arranged its business would become a participant in the expenditure,—consequently, in the laying of the third rail, the total cost would soon be divided up into small sums among the various

companies, who would yet have all the advantages to be gained by the adoption of the three feet gauge and the third rail.

VIII.—RECAPITULATION.

After recapitulating the foregoing results, with a few general remarks, we will close with an examination of the effect which a narrowing of the gauge would have on the Western Maryland Railway. The figures and the facts already adduced, demonstrate wondrous things; yet in all sincerity we cannot but receive and acknowledge them as reasonable.

CONCLUSION.

(1.) *Saving Demonstrated.*—They tell us that by constructing a three feet road, one hundred miles long, destined to do a large coal tonnage—instead of the four feet eight and one-half inch gauge,—the saving would be sufficient in ten and one-half years, if compounded at seven per cent., to repay all but $6,200 per mile of the entire cost of an expensively constructed railway; or, taking the most moderate view of it, that in this period of time, after making even unreasonable allowances for contingencies, *one-half of the total cost of the road and its furniture will be wiped out.*

(2.) *Surplus Earnings.*—That from an *increase of paying weight,* and by reason of the *decrease of unproductive rolling stock weight,* the three feet road can earn against 26 4-10 grades $308,880 more each year for its gross revenue in coal transportation alone; further, that on maximum grades of forty feet per mile it would have an annual surplus of net earnings amounting ting to $238,680; again, that sharp curvature, so destructive to the rolling stock of standard gauges, can be traversed without injurious effect on the three feet roads.

(3.) *Cost of Outfit.*—That the cost of outfit is about twelve per cent. less, and about half the weight for the same business.

(4.) *Speed and Stability.*—That the speed which is now maintained in our regular railway traffic can be fully adhered to on the three feet lines, and that the passenger coaches on these roads have equal stability, and, in certain cases, more safety, than those of the standard.

(5.) *Cost of Operating.*—That the cost of operating is about twenty per cent. in favor of the narrower lines.

(6.) *Revenues and Dividends.*—That the net revenues of the wide road may reach seven per cent., while those of the three feet as surely promise twenty per cent.,—which demonstrates that charges for the transportation can be reduced to the public on the three feet road.

(7.) *Three Feet Branches to Connect with the Standard Roads.*—The three feet branches can be built advantageously to connect with the standard roads, even where transhipment is unavoidable; that such transhipment, after the arrangements are once consummated, can be made at six to ten cents per ton; and, further, that our present trunk lines should see it to be for their interest to lay down a third rail for the accommodation of the *host* of three feet branches that would forthwith seek a union with them.

GENERAL REMARKS.

The strong position occupied by the standard gauges, backed by their all-powerful interests, should have been potent enough to silence all the advocates of the three feet gauge, did not the new system carry with it great truths, stronger than the twenty-five hundred millions of dollars that represent the capital of its predecessor in the United States.

CONSERVATISM OF CAPITAL.

This large vested interest, coupled with a natural tendency to follow old plans and the paths we have so long trod, produces doubts and suspicions; but we can all remember with what doubt wise men regarded many changes and enterprises that have proved grand successes. Look at ocean steam navigation!—at the electric telegraph!—at its resultant, the great ocean cables! Bear in mind the seven-mile tunnel through the Alps,—the junction of the Red and Mediterranean Seas by a ship canal that cost $350,000,000 to put it in operation! Remember our own great Pacific Roads, that no living man ever dared to hope he would see consummated! And we may mention the engineering triumphs of the late lamented Roebling, that leaps the falls of Niagara in 820 feet, which sapient men in both hemispheres asserted it was impossible to build out of its 1,000 tons of materials, because, forsooth, "Britannia Bridge," of only 460 feet span, required 3,000 tons of iron for its construction over the Straits of Menai. And is not the change of twenty and a half inches from the old railway gauge insignificant as a departure from previous experience compared to any of the preceding? Surely it is so; yet this little alteration promises results that will increase the commercial and social prosperity of the world perhaps as much as any of those just mentioned. And what justifies any one in saying that our old plan is alone correct? The present gauge was established without precedent. It almost came by chance; while the proposed proportion has been forced on us to conviction by proof incontestable, and we are compelled to acknowledge that it has so much of merit that it is our plain duty not to go on perpetuating our former errors. It is, indeed, a matter of some surprise how little and how weak has been the opposition to the contemplated innovation; even men of large interests in the standard lines view the proposition with favor, and men of investigating minds everywhere are looking into it. So startling are the results of the investigations that some seem constrained to move with caution and to feel their way; but the tide is coming on, and soon it will be at the flood. Let wisdom and moderation conduct the affairs of the new lines, and a great triumph over old ideas will be the result.

We think the impartial investigation we have given the whole subject, and the care we have bestowed upon it, justify us in tendering it with confidence to those interested.

We leave to all to judge if it be wise to continue the exclusive use of a gauge, the full capacity of which cannot be made available. It is an important decision,—yet not, we should imagine, a difficult one to make, although measured in value by two thousand millions of dollars; for that sum will be *saved* on the 80,000 miles of new railways now projected, by adopting a gauge twenty and a half inches less than the standard.

IX.—WESTERN MARYLAND ROAD.

To the President of the Western Maryland Road:—

We submit the question to you as President of the Western Maryland Railway, believing that the statements made are sufficiently explicit to enable you and your co-interested to judge wisely, and to decide on the course most beneficial to adopt in reference to your own work. On your action may depend the future success not only of the Western Maryland Railway, but of a long line destined to be one of the main arteries of the railway system of your State.

PROPOSED EXTENSION.

The surveys about to be commenced westward to the coal fields will take character from the decision, and it will stamp for all time, upon a great public improvement, features that will be unalterable. In examining how the present and future prospects of your own road will be affected by the change of gauge, we submit that in all the views that can be taken from our stand-point, the same bold objects are discernable in the very foreground.

These objects are: (1). Greater adaptability of the road to the service that will be required of it. (2). Increased value. (3.) Capability of transportation enlarged more than a hundred fold. (4). The most prominent of all—financial prosperity. These may seem to be very great promises, and so they are; but we assert they can be made good, and will now exemplify them.

(1). *Road better fitted for work.*—The construction features of the Western Maryland Railway, and most other lines through a similar country, are such as to invite peculiarly the adoption of the three feet gauge—and for the staple traffic of the road, that will one day plow down this channel in a constant stream to the tide waters of Baltimore harbor,—the narrowing the gauge will afford special advantages, which in a future report can be enlarged on. These will increase the capability of the road, and they redeem our first promise.

(2). *Increased Value.*—The Western Maryland Railway has been well graded for *one* track of the standard gauge. Its road bed is wide enough, with the addition of only eighteen inches on each side, to accommodate nicely, *two* tracks of three feet gauge, giving five feet between them with water tables of two feet each, and cross-ties six feet long. The cost of preparing the present road-bed for double three feet tracks, would not in our judgment exceed three thousand dollars per mile, and this would make your Western Maryland Railway, of one hundred per cent. more valuable than is represented by its present cost. Here is the full redemption of our second promise of "large and increased value."

(3). *Increased Capability.*—The capability of a single track to do a business is limited,—yes, very limited, unless worked by experienced officers under a full telegraphic system; hence, when you double the track, you do much more than double its capacity; this will make good our third promise of "increased capability."

(4). *Financial Prosperity.*—"Financial prosperity," is the fourth and last of our assurances. This needs no more perfect elucidation than will be found in the preceding pages, especially under the head (VI.) of "Revenue."

There can be no question, we submit, as to whether the Western Maryland Railway with its *one* track, laboring under whatever disadvantages are common to roads of its class, will earn more for its proprietors, and carry its freight at lower rates for its customers, than if it be clad with a *double track*, backed by the advantages specified in our report, and given an ability to supply the port of Baltimore at Canton with all the tonnage its improved wharves can ship.

HOW THE CHANGE CAN BE MADE.

The steps requisite will not be difficult, and need not interrupt the business of your road, because the Western Maryland Railway can be retained for a given time at its present gauge, and a third rail be laid, to accommodate the coal trade and general traffic, of the three feet road, so as to give you an opportunity to dispose of your wide rolling stock to advantage—the proceeds of which will more than replace the plant requisite for a similar business on the narrower tracks; and when this is perfected, the one rail of its first line can be shifted to the position for the second track, which can be completed easily by the laying of a line of one rail in addition; thus making the Western Maryland Railway a perfect double track road, equal to a tonnage of three millions of coal per annum, without loss of business. The change proposed is just what the Russian Government made on the Poti line, of two hundred and twenty miles, when its gradiation was far advanced and even a portion of its track laid.

England, for her ten thousand miles of Indian Railway, has adopted the smaller gauge. France, Belgium, Sweden, Norway and Prussia have it in operation. Austria, Spain and Italy are its advocates, and in our own great land, Massachusetts, New York, Pennsylvania, Maryland, Ohio and Georgia are all building it. Colorado has one road, of three feet, running through her great mineral districts for eight hundred and fifty miles, with eighty miles of it in operation; while it has just been proposed to build the "Southern Pacific Railway" of the gauge we advocate. Concerning this letter, Mr. Stebbins, a New York capitalist, writes to the President stating:

"In my opinion it will be impossible to resist the weight of testimony in favor of these railways, over any other gauge, and I certainly agree with you, that the discovery of their efficiency *will do more for the South and the South-west, than could have been done by ony other human means.* I regard the successful agitation of the matter at this time as equal to the discovery and introduction of the cotton-gin, to the whole Southern section of the country."

After a minute investigation of the entire subject, we submit our views to you as President, of the Western Maryland Railway, and to the corporation and gentlemen interested in its extension to the coal basin; and we beg respectfully to add, that the adoption of the three feet gauge for the whole route we professionally advise and recommend.

We are, sir, your obedient servants,

RICHARD B. OSBORNE,
Engineer Western Maryland Railroad.
CHARLES P. MANNING,
Civil Engineer.

BALTIMORE, December 20, 1871.

COST OF CANADA NARROW-GAUGE ROADS.

TORONTO AND NIPISSING RAILROAD—THREE FEET SIX INCHES GAUGE.

TORONTO, 24th June, 1872-

Cash cost—Scarboro' Junction to Uxbridge—thirty-two miles.

	TOTAL.	PER MILE.
Grading, fencing, ties, bridges and culverts,	$151,307	$4,725
Rails and fastenings, - - - - - -	139,041	4,345
Tracklaying and ballasting, - - - -	46,696	1,460
Station building, - - - - - -	15,012	470
Right of way, - - - - - - -	22092	690
Telegraph, - - - - - - -	1,500	47
Engineering, - - - - - - -	14,110	441
Commissions, offices and Directors' fees,	10,292	321
Law expenses, - - - - - - -	936	30
Sundries, - - - - - - -	615	20
	$401,601	$12,549
Rolling stock, - - - - - -	101,588	3,175
	$503,289	$15,724

The Toronto & Nipissing Railway, from Scarboro' Junction to Uxbridge, has cost in cash the sum of $12,549 per mile, exclusive of rolling stock, or including rolling stock $15,724 per mile. The earthwork has averaged 9,750 c. yds. per mile. The line is fenced throughout at a cost of $700 per mile. The ties have cost $480 per mile on this section, and the grubbing, clearing and slashing $140 per mile.

EDMUND WRAGGE, Chief Engineer.

TORONTO, GREY AND BRUCE RAILWAY—THREE FEET SIX INCHES GAUGE.

TORONTO, 24th June, 1872.

Cash Cost—Weston Junction to Orangeville—forty-one miles.

	TOTAL.	PER MILE.
Grading, fencing, ties, bridges and culverts,	$196,595	$4.795
Rails and fastenings, - - - - - -	181,015	4,415
Tracklaying and ballasting, - - - -	67,770	1,653
Station buildings, - - - - - -	24,407	595
Right of way, - - - - - - - -	24,600	600
Telegraph, - - - - - - - - -	1,640	40
Engineering, - - - - - - -	23,370	570
Commissioners' offices, Directors' fees, etc.,	15,469	377
Law expenses, - - - - - - -	3,936	96
Sundries, - - - - - - - - -	2.000	49
	540,802	13,190
Rolling stock, - - - - - -	105,960	2,560
	$646,762	$15,750

The Toronto, Grey & Bruce Railway has cost in cash, as per detailed estimate annexed, $13,190 per mile exclusive of rolling stock, and including rolling stock $15,750 per mile, between Weston Junction and Orangeville (the portion of the road which is entirely completed). The earthwork averages 10,500 c. yds. per mile. The line is fenced throughout at a cost of $800 per mile. The grubbing amounts to an average of one-half an acre per mile; the clearing to three acres per mile. Slashing on each side of the railway to the extent of four acres per mile has also been done. The grubbing, clearing and slashing having together cost $140 per mile. The ties have cost on this section an average of twenty-five cents each, or $500 per mile.

EDMUND WRAGGE, Chief Engineer.

OPINIONS

OF

ENGINEERS AND OTHERS ON NARROW-GAUGE.

HON. H. G. STEBBINS, VICE PRESIDENT SOUTHERN PACIFIC RAILROAD.

In the summing up of the able article written by this gentleman, he says:

"To sum up all, the narrow-gauge system clearly has the advantage in these particulars. First—In the large comparative saving in first construction, and right of way. Second—In the larger proportion of paying load to non-paying weight of train. Third—In the great reduction in wear and tear of permanent way, through the advantage gained by using lighter rolling stock. Fourth—In the great saving in the reduced wear and tear of wheels and tires, from the reduced weight on each wheel. Fifth—In the large proportionate increased power of locomotives (from the dead weight on the engines being used as tractive power). Sixth—In proportionate increased velocities gained by the light system. Seventh—In the greater economy in working traffic; and, Eighth—In the comparative increase in the capacities of traffic."

DENVER AND RIO GRANDE RAILROAD—THREE FEET GAUGE.

The Denver & Rio Grande Railroad Company is practically demonstrating the superiority of the new system over the old, by having undertaken to construct a three feet gauge road over the almost entirely undeveloped country lying between the Union Pacific Railroad and the Rio Grande, a distance of eight hundred and fifty miles and upwards.

Eighty miles of this road is in successful operation from Denver to Pueblo City, built at a cost not to exceed $13,500 per mile, and fully equipped.

The engines adopted by the company are of the same pattern as the standard engines on the Pennsylvania roads, with slight modifications.

A special correspondent of the Omaha *Herald*, writing from Colorado Springs, December 24th, says:

"NARROW-GAUGE.

"The Denver & Rio Grande Railway (narrow-gauge) remains open, notwithstanding the snow. It has not yet failed a single day in getting a train through between this place and Denver, although it crosses 'the great Divide.' next to the highest road pass in the world, and two hundred feet higher than the Sierra Nevadas on the Central Pacific."

COMPARISON BETWEEN THE PENNSYLVANIA AND DENVER RAILROADS.

The standard passenger engine on the Pennsylvania road weighs 40,000 pounds (double that of the Denver road), and a total weight of 105,000 pounds, or fifty-two and one-half tons. The usual load of passenger trains consists of

	TONS.
4 Passenger cars seating fifty-three passengers each and weighing - - - - - - - - - - - -	76
1 Baggage car - - - - - - - - - -	14
Engine and tender - - - - - - - -	52 1-2
Total - - - - - - - - - - -	142 1-2

This train will accommodate two hundred and twelve passengers if full.

The same number of passengers on the Denver road require

	TONS.
6 Passenger cars, weighing - - - - - - -	42 1-2
1 Baggage car - - - - - - - - - - -	4
Engine and Tender - - - - - - - - - -	15 1-2
Total - - - - - - - - - - -	61 1-2

Or less than *forty-five hundredths* the weight of the standard train to do the same business.

Sleeping cars, as comfortable in every respect as on the standard gauge, can be used on the road without difficulty.

In the freight train the comparison is about as follows:

	WEIGHT ON DRIVERS.	WEIGHT OF ENGINE AND TENDER.		LOAD ON LEVEL EXCLUSIVE OF ENG'N & TENDER.
	LBS.	LBS.	TONS.	TONS.
Freight Eng. standard gauge,	60,000	114,000	57 1-2	1440
Denver & Rio Grande, 3 ft. gau.	30,000	41,000	20 1-2	722

Of this load on full gauge road the proportionate weight of cars being one to one of freight, there is

	TONS.
Weight of cars - - - - - - - - - - - -	720
Of freight - - - - - - - - - - - -	720

On the three feet gauge the proportionate weight of car to load is one to two and one-fourth of freight; we have

	TONS.
Weight of cars - - - - - - - - - - - -	206
Of freight - - - - - - - - - - - - - -	618

Or nearly *nine-tenths* of the paying weight hauled by the large engine.

EXTRACTS FROM LETTERS.

By J. D. Hoff to General C. B. Stuart, Consulting Engineer, New York, dated Denver, Dec. 8th, '71.

Mr. Huff visited this road in company with other distinguished scientists from the Atlantic States during the late snow storms in December, and witnessed the progress of a train of fifteen cars on a small engine of ten and one-half tons. He says:

"I found the heaviest grades sixty-five feet per mile and the sharpest curves nine degrees. The length to Colorado City is twenty-six miles; total cost, $13,500 per mile.

The Kansas Pacific Railway, built by the same engineer, General Greenwood, cost $24,000 per mile, and the difference in grading is in favor of the latter road.

The largest locomotive weighs twenty and one-half tons. The passenger cars seat thirty-four passengers as comfortably as any cars in this territory, and, with two closets and stove, weigh only 13,000 pounds. Their freight cars weigh 3,500 pounds, and carry a load of 10,000 pounds when full, or nearly *three pounds of* *load to one of car. One ton of coal* runs a train of *seventy-five tons of freight eighty miles in four hours.* Their books show that the round trip of one hundred and fifty-two miles costs about *fifty dollars;* or *two and one-third tons one mile for one cent.* The trains went through the deep snow, beating all the other roads this winter.

The divide over which the train runs is 7,000 feet above tide water, and while the U. P. and the K. P. roads in the same territory have been blockaded for weeks at a time, this little road had not lost a trip up to the middle of December, and was never more than two hours behind time on any trip during the winter.

ORANGEVILLE RAILROAD.

The Orangeville *Advertiser*, Canada, in speaking of the Toronto & Bruce narrow-gauge, says:

"The amount of goods which is brought is truly surprising, and the number of passengers traveling both ways is also very large. The fact is, the railroad is a great success; having gone to Toronto and back on the line the present week, we were agreeably surprised at the comfort of the journey. We have heard a good deal of the 'narrow-gauge,' the 'wheelbarrow railway,' but let anybody get into the cars without being told anything about narrow-gauges, and we venture to say that he would not observe the difference between it and any other railway. The cars are seated in the same way as the wide gauge, each seat accommodating two comfortably; the track, too, is very smooth.

RUSSIAN SYSTEM.

The system of roads in this country have been reduced from six feet and under to the present standard of three feet and six inches, carrying regularly three hundred and fifty-four tons of train, exclusive of engine and tender, on grades of one in eighty-five, some of which are five miles long. Total freight carried per annum, 376,430 tons; total number of passengers carried per annum, 189,762, at a cost of one and one-half cent per mile, and freight at two cents per mile.

CONCLUSIONS OF MR. SPOONER ON FESTINIOG AND THREE FEET GAUGE.

First—That through the whole time he has had the control of the Festiniog railroad it has entirely demonstrated the theory of the immense saving on the narrow-gauge system; in having carried more freight and passengers at less cost than any line of railway now in use; that it is almost free from oscillation; that it has withstood the severest wind storms in the country without being affected; that the cars can run at thirty-five miles per hour with perfect safety; that the wear and tear of rolling stock and rails is reduced to an absolute minimum.

Secondly—That a two feet nine inches to three feet gauge meets the only objection that can now be raised against a narrow-gauge, and that all the requirements of commerce can be fully transacted by lines built on that gauge; that they can be built for from one-fourth to two-fifths of the cost of the standard gauge through the same section of country, and can be maintained at not to exceed one-half of the cost of the present system to do the same business.

THE ULLENBORG ROAD IN SWEDEN—GAUGE THREE FEET SEVEN INCHES—LENGTH THIRTY-SEVEN MILES.

This road reports a business of 220,000 passengers and 327,000 tons of freight per annum, carried at per passenger two and one-sixteenth cents per mile, and for freight at two and five-sixteenth cents per mile per ton, at speed of thirty-five miles per hour, with a twelve ton locomotive, revenue about fifteen per cent. per annum.

Major Adelskold, State Engineer of Sweden, says:

In every case where small gauge railroads have been built they have realized every expectation, and I deem it a waste of money to build broader gauge where a narrow and cheaper gauge will meet all the requirements of the business of the country.

SPECIAL CONCLUSIONS FROM THE ROADS ALREADY BUILT—FESTINIOG RAILWAY, THIRTEEN AND ONE-HALF MILES, TWENTY-THREE AND ONE-HALF INCH GAUGE.

The results of operations of this road are:

Passengers transported yearly, 140,000 passengers at one cent per mile.

Freight hauled, 500,000 tons at one-third cent per ton.

Original cost, $180,000.

Present value, $500,000.

Interest on original investment, forty per cent. per annum.

Interest on present value, twenty-three per cent. per annum.

Maximum gradients, one in sixty-seven.

" Curves, one hundred and thirty-two feet radius.

" Weight of Engines, ten to nineteen and one-half tons.

Proportion of non-paying passenger traffic, one-half ton per passenger.

Proportion of paying to non-paying freight, three to one per ton.

Freight cars 1,344 pounds, carrying three and one-half tons.

THE LAREN ROAD IN NORWAY—GAUGE THREE FEET SEVEN INCHES—LENGTH SEVENTY-THREE MILES.

Constructed by Mr. Pihl at a cost of $25,000 per mile. Reports annual income of fifteen per cent. on the cost, at three cents per passenger per mile, and two and three-fourths cents per ton per mile. Locomotives, eighteen tons; grades, one in sixty-two; curves, two hundred and thirty-seven feet radius; speed, thirty-five miles per hour.

The Hamer road in Norway, thirty inch gauge, constructed by Mr. Pihl at a cost of $15,000 per mile. Rails thirty pounds per yard; locomotives, twelve to twenty tons; grades, one in eighty; and curves four hundred feet radius, at three cents per mile per passenger, and two and five-sixteenth cents freight per mile carried; annual dividends, nearly seventeen per cent. Speed twenty-six miles per hour.

Cost of standard gauge in the same country, $32,000 per mile, pays at same rate of charges less than eight per cent. per annum.

OPINION OF W. STUART WATSON, ESQ., CIVIL ENGINEER, SAN FRANCISCO, CAL.

It will be admitted that the chief difficulty in building railroads anywhere is their cost. This difficulty hinders the building of many roads that would pay if they were built.

The present standard gauge railroads in the United States have cost about $44,000 per mile, the construction of which has created an indebtedness of nearly 2,200 millions dollars (exclusive of stock subscription), which at seven per cent. interest per annum involves the annual payment of one hundred and fifty-four millions dollars, which the commerce of the country is compelled to pay. If the present system is not changed, and the bond list increases in the next ten years as it has in the last, this indebtedness will amount to probably not less than 3,500 millions dollars, with an annual tax on transportation of two hundred and forty-five millions dollars.

The change that is proposed will build roads that have an equal capacity, both for freight and passenger, and upon which equally fast time can be made, for less than forty per cent.; and when built can be maintained at not to exceed one-third of the expenses of the present system. Thus two of the most formidable objections in the way of construction of railroads in sparsely settled countries would be removed—that of an exorbitant cost and an expensive system of management. There is scarcely a county in this State that could not afford to build a small gauge railroad wherever a good public highway was necessary. Even the lines already occupying our principal avenues of business would find it necessary to change the present standard or be compelled to reduce their charges to such low rates as not to be able to pay running expenses.

The cutting and filling of the road-bed will not be over one-half through a country of an ordinary even surface, curves can be used and successfully operated as sharp as two hundred feet radius, and thereby reduce the cost of construction in a heavy country to less than *twenty-five per cent. of what a standard gauge can be built for in those countries.*

The cost of permanent structure can be reduced at least one-third; ties to two-thirds. The rails will be reduced from eighty pounds per yard, to twenty-five and thirty, and their durability increased from five years to at least fifteen, with the same business.

The locomotives can be reduced in weight from twenty and sixty tons, to six and fifteen tons, made on patterns suitable to the changed gauge.

The cars will be reduced from sixteen and thirty tons to four and six and one-half tons, while the freight cars can be reduced from six and fourteen tons, to one and two and one-half tons.

The buildings can be reduced in proportion. The turn-tables and all fixtures can be reduced at least three-fifths.

This system of roads can be constructed in one-half the time required to construct the present system, and return interest proportionately enhanced.

The principal cost of maintaining a road depends upon the weight the road-bed has to carry to do its business, the proportion being as three to one of all other expenses. This is reduced in passenger traffic from one ton and three and one-half tons dead weight for each passenger; and of freight, from seven tons dead weight to one ton paying weight, on the standard gauge; the one-quarter of a ton dead weight for passengers; and to one-third ton of dead weight to one ton to paying weight for the proposed narrow-gauge system.

The present system as a result, has given over 60,000 miles of railroads, on which we are obliged to carry at least six tons of carriages to one ton of freight, and from ten to thirty tons of carriage for one ton of passengers, costing for its transportation two hundred millions dollars annually on bonds more than is necessary, and getting in return the satisfaction of knowing that we are expending millions yearly in manufacturing rolling stock for the special purpose *only* of wearing out the rails it runs on; while the practical result of the proposed change will be, economy in construction and operation, cheap freights, large dividends, adaptability to other than mountainous countries, feasibility of doubling the number of miles of our railway systems at one-third of the former outlay, the easy development of sparsely settled but valuable districts, and the long train of advantages which is sure to follow to the stockholders who invest in those roads, as well as to the people who will by their agency be induced to occupy our unsettled regions. And above all, and before all other considerations, they will constitute a means through which existing lines of standard gauge roads will be compelled to respect the convenience and necessities of the public, in reduction of freights and charges, from six cents a mile per passenger to less than two, and from ten cents per ton for freight, to at least one-third that amount.

NATIONAL CENTRAL EXECUTIVE COMMITTEE

OF

NARROW-GAUGE RAILWAY CONVENTION.

A CARD.

The Narrow-Gauge Railroad Convention, which assembled at St. Louis, June 19, adopted the following resolution:

Resolved, That in view of the necessity of concert of action, and the dissemination of information on construction and practicability of narrow-gauge railroads, a NATIONAL CENTRAL EXECUTIVE COMMITTEE, consisting of thirteen persons, be appointed, to whom all applications may be made for information, and all statistics bearing on the question be forwarded. Said committee to have full authority to call the "narrow-gauge" advocates into convention at such times and places as they may think proper, and to take such action as they may deem advisable to advance the general interests of the narrow-gauge movement.

The following named gentlemen were appointed said committee:

Hon. CHAS. H. HOWLAND, St. Louis, Mo., representing Cairo & St. Louis Railroad Company.

Col. W. H. GREENWOOD, Denver, Col., General Manager Denver & Rio Grande Railroad Company.

Col. E. HULBERT, Atlanta, Ga., President Northern Georgia & North Carolina Railroad Company.

Col. W. C. FAULKNER, Ripley, Miss., President Ripley & Gulf Railroad Company.

Hon. P. B. BORST, Luray, Va., President Washington, Cincinnati & St. Louis Railroad Company.

W. S. AUCHINCLOSS, Wilmington, Del., Vice President Jackson & Sharp Car Company.

EDMUND WRAGGE, Esq., Toronto, Canada, Chief Engineer and